



# Advanced Spectrum Management Features for the Cisco uBR-MC16S Spectrum Management Card

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This feature module describes the Advanced Spectrum Management Features that are available for the Cisco uBR-MC16S line card in Cisco IOS software Release 12.1(7)CX1. It describes the benefits of the new features, the supported platforms, related documents, and new commands.

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## Feature Overview

The Cisco uBR-MC16S cable interface line card is a card with a DOCSIS-based cable interface that supports one downstream and six upstreams. It incorporates a daughterboard with hardware-based spectrum management features that provide the following features:

- Integrates a DOCSIS cable interface line card with an onboard spectrum analyzer that continuously analyzes the upstream spectrum quality in the DOCSIS frequency range of 5 to 42 MHz.
- Includes hardware-assisted frequency hopping, providing for more intelligent and faster frequency selection than software-only solutions.
- Reduces the response time to ingress noise that could cause modems to drop offline.
- Eliminates blind frequency hopping by initiating frequency hops to known clean channels.

- Improves frequency agility to help eliminate dropped packets and thereby maintain full upstream data rates.
- Supports frequency agility in dense-mode combining environments across a shared spectrum.
- Restricts frequency hopping to a set of discrete frequencies or to a range of frequencies, as desired.
- Allows frequency hop conditions to be customized for specific plant environments and requirements.
- Optionally schedules frequency hops to take advantage of known usage patterns or plant conditions.
- Optionally dynamically reduces channel width to allow cable modems to remain online, even in noisy upstream conditions.
- The Cisco uBR-MC16S line card can be installed in existing deployments of the Cisco uBR7223, uBR7246, and uBR7246 VXR universal broadband routers.
- As is the case with the other cable interface line cards, the Cisco uBR-MC16S line card supports Online Insertion and Removal (OIR), allowing for hotswappable upgrades and maintenance.

The Advanced Spectrum Management Features for the Cisco uBR-MC16S cable interface line card, available in Cisco IOS Release 12.1(7)CX1, are a software-only upgrade that provides the following additional features:

- Supports proactive channel management, so as to avoid the impacts of ingress and keep subscribers online and connected.
- Offers flexible configuration choices, allowing users to determine the priority of the actions to be taken when ingress noise on the upstream exceeds the allowable thresholds. The configurable actions are frequency hopping, switching the modulation profile, and reducing the channel width.
- Performs CNR calculations using DSP algorithms in real-time on a per-interface and a per-modem basis.
- Intelligently determines when to modify the frequency, channel width, or modulation profile, based on CNR calculations in the active channel, the number of missed station maintenance polls, and the number of correctable or uncorrectable Forward Error Correction (FEC) errors. Previously, channel hopping occurred when the number of missed station maintenance polls exceeded a user-defined threshold or the SNR reported by the Broadcom chip exceeded the DOCSIS thresholds.
- Enhances the Dynamic Upstream Modulation feature for the Cisco uBR-MC16S line card. This feature supports dynamic modulation using two upstream profiles. The primary profile (typically using 16-QAM or a mixed modulation profile) remains in effect at low noise conditions, but if upstream conditions worsen, the cable modems switch to the secondary profile (typically using QPSK modulation) to avoid going offline. When the noise conditions improve, the modems are moved back to the primary profile.




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**Note** The Dynamic Upstream Modulation feature was introduced in Cisco IOS Release 12.1(3a)EC1. The above enhancements to this feature currently exist only in 12.1(7)CX1; they do not exist in any 12.1 EC release.

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- When using a Cisco uBR-MC16S line card on a Cisco uBR7200 series router running Cisco IOS Release 12.1(7)CX1, the spectrum management hardware uses the real-time CNR readings from the DSPs onboard the Cisco uBR-MC16S line card instead of the signal-to-noise ratio (SNR) values from the Broadcom 3137 chip to determine the signal quality of the upstream channel. The CNR value is a more accurate description of noise conditions on the upstream.

- Provides an SNMP interface so that a network management workstation or other graphical tool can obtain spectrum information for either a particular cable modem or for an entire upstream. The frequency resolution can be as fine as 12 KHz.



**Note** The CISCO-CABLE-SPECTRUM MIB has been enhanced to provide this support.

- Supports the DOCSIS Cable Modem Test Analyzer (DCMTA) from Acterna. The DCMTA software provides spectrum analyzer capability for an individual upstream port or an individual cable modem. Spectrum data is extracted from the Cisco uBR-MC16S cable interface line card using SNMP, allowing for live troubleshooting of an upstream port or individual cable modem. The DCMTA software supports simultaneous client access to a single or multiple CMTS, upstreams, or cable modems.



**Note** To contact Acterna about the DCMTA software, call 1-800-638-2049 or +1-301-353-1550, or visit <http://www.acterna.com>.

## Benefits

The Cisco uBR-MC16S cable interface line card offers the following key benefits:

- Improves response time to ingress noise impairments that appear in the upstream return path.
- Eliminates the need for unnecessary frequency changes.
- Boosts the percentage of modems on-line.
- Mitigates the impact of ingress to subscriber services.
- Saves time and effort by MSO operations staff when troubleshooting minor plant outages.
- Increases cable plant reliability.
- Maximizes spectrum utilization.

The Advanced Spectrum Management Features for the Cisco uBR-MC16S cable interface line card that are available in Cisco IOS Release 12.1(7)CX1 adds the following new key benefits:

### Hardware-Assisted Spectrum Management

- Off-loads much of the spectrum management processing from the main system processor to the digital signal processing (DSP) hardware on-board the Cisco uBR-MC16S line card, freeing up the main processor for other duties.

### Intelligent Frequency Hopping

- Proactively changes upstream frequency for an interface before noise conditions become severe enough to force cable modems offline.
- Flexible priority configuration allows hopping decision criteria to be tailored to the individual cable plant environment.
- Improves responsiveness to ingress impairments, by matching the hopping decision criteria to the fluctuating plant conditions.
- Pinpoints CNR variations and other trouble spots in the upstream return path with per-modem accuracy to isolate problematic cable modems.

- Sustains or even improves subscriber on-line percentages through user-programmable pro-active channel management techniques.

#### Dynamic Upstream Modulation

- Reduces the risk associated with switching between QPSK and 16-QAM modulation in the upstream to respond to ingress noise, so that subscribers remain online and connected.
- Checks the current upstream signal to ensure it can support the configured modulation scheme, and proactively adjusts to the secondary, more robust modulation scheme when necessary.
- Eliminates unnecessary frequency hopping by switching modulation profiles to one that allows cable modems to remain online while using the currently assigned upstream.
- Provides assurance that subscribers remain on-line and connected during periods of return path impairments

#### SNMP Interface

- Provides a way to remotely obtain the current status of noise on an upstream. This information can then be inserted into third-party or custom reporting and graphing applications.
- Provides visibility to ingress and impulse noise under the carrier frequency on a per-port basis.
- Provides an easy-to-use, distributed method to remotely gather real-time display of the DOCSIS upstream spectrum for individual cable modems and STBs.
- Reduces the reliance on costly spectrum analyzers at every headend or hub.
- Quickly provides spectrum views through an intuitive interface, without the complicated setup time of a spectrum analyzer.
- Allows the technician to troubleshoot the network remotely, as opposed to having to be physically present to connect and use a spectrum analyzer.
- Supports the DOCSIS Cable Modem Test Analyzer (DCMTA) from Acterna Corp.

## Restrictions

#### Cisco IOS Software Release

The initial spectrum management enhancements to the Cisco uBR-MC16S line card were introduced in the 12.1 EC release train. The advanced features described in this document require Cisco IOS Release 12.1(7)CX1.

#### Cisco uBR-MC16S Line Card

The following restrictions apply to the Cisco uBR-MC16S line card:

- The Cisco uBR-MC16S line card is not supported in any release of Cisco IOS Release 12.0SC.
- Upstream channels must meet the CNR and carrier-to-ingress power ratio values given in the DOCSIS specifications. The minimum value for both parameters is 25 dB in the 5–42 MHz frequency range.
- The Advanced Spectrum Management features do not support shared spectrum groups, requiring that each upstream port on the Cisco uBR-MC16S line card must have its own RF domain (a unique set of non-overlapping frequencies).
- Cisco IOS Release 12.1(7)CX1 does not support HCCP 1+1 redundancy when using the Cisco uBR-MC16S cable interface line card.

### DOCSIS 1.1 Concatenation

DOCSIS 1.1 requires that the maximum transmit burst size be set to either 1522 bytes or the maximum concatenated burst size, whichever is larger. Do not set the maximum concatenation burst size in the DOCSIS configuration file to values larger than 1522 bytes for DOCSIS 1.0 cable modems, unless you have turned off concatenation on the CMTS using the **no cable upstream concatenation** command.

### DOCSIS Cable Modem Test Analyzer

The DOCSIS Cable Modem Test Analyzer (DCMTA) software from Acterna Corp. is designed for troubleshooting ingress and other problems on the return path in real-time, not for ongoing monitoring of the upstream spectrum. Constant use of the DCMTA tool could result in excessive volumes of SNMP traffic that affects network bandwidth and performance on the Cisco uBR7200 series CMTS. For this reason, Cisco recommends against running the DCMTA software continuously. Instead, start the software when needed and exit it after the problem has been resolved.

### Dynamic Upstream Modulation

The following restrictions apply to the Dynamic Upstream Modulation feature:

- This feature module describes the Dynamic Upstream Modulation feature as it applies to the Cisco uBR-MC16S line card. This feature is available in a different form for other line cards; see the *Cisco uBR7100 Series Dynamic Upstream Modulation* feature module for details.
- Upstream modulation profiles are assigned to upstream ports and affect all cable modems on those upstream ports.
- Modulation profiles affect the physical layer of the cable network, so only trained technicians who are familiar with the DOCSIS specifications should create modulation profiles.
- When using the Dynamic Upstream Modulation feature with Voice over IP (VoIP) services, frequent changes to the upstream modulation or channel width could briefly impact the quality of voice calls.

### Fixed -Frequency Spectrum Groups

Fixed-frequency spectrum groups should not be configured by specifying a single frequency using the **cable spectrum-group frequency** command (for example, **cable spectrum-group 3 frequency 7600000**). If single-frequency spectrum groups are desired, configure a band with a starting and ending range, which along with the desired channel width, specifies the desired center frequency. In this situation, you must also configure a static channel width so that the dynamic upstream modulation feature does not attempt to hop to a different frequency using a smaller channel width.

For example, to specify a center frequency of 7.6 MHz with a 3.2 MHz channel width, specify a starting frequency of 6.0 MHz (7.6 MHz - 1.6 MHz) and an ending frequency of 9.2 MHz (7.6 MHz + 1.6 MHz):

```
CMTS(config)# cable spectrum-group 15 band 6000000 9200000
CMTS(config)# int c6/0
CMTS(config-if)# cable upstream 0 channel-width 3200000 3200000
CMTS(config-if)# cable upstream 0 spectrum-group 15
CMTS(config-if)#
```

## Related Features and Technologies

**Table 1** Cisco uBR7200 Series Universal Broadband Router Features

Feature	IOS Release
Upstream Traffic Shaping Feature	11.3(9)NA
Blind Frequency Hopping and Time Scheduled Frequency Hopping Support	12.0(5)T1

**Table 1 Cisco uBR7200 Series Universal Broadband Router Features**

Feature	IOS Release
Guided Frequency Hopping	12.0(5)T1
Enhanced Spectrum Management	12.0(5)T1
Initial CISCO-CABLE-SPECTRUM MIB with Flap List Support	12.0(5)T1
Cisco uBR-MC16S Line Card Support	12.0(7)XR3 and 12.1(1a)T1
Dynamic Upstream Modulation	12.1(3a)EC1

## Related Documents

### IOS Documents

- *Cisco IOS Release 12.1 Multiservice Applications Configuration Guide*
- *Cisco IOS Release 12.1 Multiservice Applications Command Reference*

### Cisco uBR7200 Series Universal Broadband Router Documents

- *Cisco uBR7200 Series Configuration Notes*, Release 12.1
- *Cisco uBR7200 Series Universal Broadband Router Software Configuration Guide*, Release 12.1
- *Cisco uBR7200 Series Universal Broadband Router Hardware Installation Guide*, Release 12.1
- *Cisco uBR7200 Series Software Release Notes and Features*, Release 12.1
- *Regulatory Compliance and Safety Information for the Cisco uBR7200 Series Universal Broadband Router*

### Spectrum Management Documents

- *Amplitude Averaging Compensation on the Cisco uBR7200 Series Cable Router*
- *Blind Hopping Support on the MC16S Modem Card for the Cisco uBR7200 Series Cable Router*
- *Cisco uBR7246 Universal Broadband Router Feature Enhancements* (see the **spectrum-group** commands)
- *Cisco uBR7200 Series Dynamic Upstream Modulation*, Release 12.1
- *Cisco uBR7200 Series MC16S Cable Modem Card Spectrum Management*
- *Cisco uBR-MC16S Spectrum Management Enhancements*
- *Enhanced-Spectrum Management and Telephone Return for the Cisco uBR7200 Series Cable Router*
- *Cisco uBR7200 Series Universal Broadband Router Feature Enhancements*
- *Configuring and Activating Frequency Agility* section in the *Understanding System Operations* in the *Cisco uBR7200 Series Universal Broadband Router Software Configuration Guide*

## Supported Platforms

The following platforms support all features listed in this feature module:

- Cisco uBR7223 with Cisco uBR-MC16S line card
- Cisco uBR7246 with Cisco uBR-MC16S line card
- Cisco uBR7246 VXR with Cisco uBR-MC16S line card

**Note**

An SNR-based version of the Dynamic Upstream Modulation feature is available on Cisco uBR7100 series universal broadband routers and on Cisco uBR7200 series universal broadband routers that use the Cisco uBR-MC1xC, uBR-MC28C, and uBR-MC16E line cards.

## Supported Standards, MIBs, and RFCs

### Standards

- DOCSIS 1.0
- DOCSIS 1.1

### MIBs

- CISCO-CABLE-SPECTRUM-MIB

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

### RFCs

No new or modified RFCs are supported by this feature.

## Prerequisites

- Cisco IOS software Release 12.1(7)CX1
- Cisco uBR-MC16S line card
- Ensure your network supports reliable broadband data transmission. At minimum, your network must include:
  - A Dynamic Host Configuration Protocol (DHCP) server to assign IP addresses to cable modems or set-top boxes on the hybrid fiber/coaxial (HFC) network. This can be a server on the WAN side of the Cisco uBR7200 series router or the Cisco uBR7200 series router that has been configured to act as the DHCP server.
  - Cisco uBR7200 series-compatible IF-to-RF upconverter installed in the downstream data path at your headend site. The upconverter is installed between the Cisco uBR7200 series router and the combiner.

**Note**

The term “combiner” refers to all cables, amplifiers, and taps at the headend or cable distribution center that connect the Cisco uBR7200 series router to the HFC network.

- Diplex filters installed in the downstream RF path between the cable modems and the cable line cards in the Cisco uBR7200 series router. RG-59 headend coaxial cable with the maximum braid available (60 percent + 40 percent braid), double foil, and the correct connector for this cable.

- Complete a basic configuration of the Cisco uBR7200 series as described in the *Cisco uBR7200 Series Universal Broadband Router Software Configuration Guide*.
- Avoid frequencies with known ingress problems such as amateur radio bands or short-wave bands.
- Avoid hostile spectrums below 20 MHz.
- When designing your channel plan, allow extra bands for frequency hopping.
- Use the receive power level setting to perform slight equalization adjustments.
- Due to the nature of CATV technology, upstream noise management is a significant issue. Cisco recommends that you follow the rigorous North American plant maintenance procedures that are documented in the *NCTA Supplement on Upstream Transport Issues* (available from the National Cable and Telecommunications Association, <http://www.ncta.com>) to adjust return amplifiers and lasers.

## Configuration Tasks

See the following sections for configuration tasks for the Cisco uBR-MC16S Line Card Spectrum Management Enhancements feature. Each task in the list is identified as either optional or required.

- [Configuring Spectrum Groups, page 8](#)
- [Configuring Dynamic Upstream Modulation, page 10](#)
- [Configuring Proactive Channel Management, page 12](#)
- [Verifying the Spectrum Management Configuration, page 13](#)

## Configuring Spectrum Groups

Frequency hopping cannot be done without first creating one or more spectrum groups, which define the specific frequencies that are available to an upstream. A spectrum group can contain a range of frequencies as well as a list of multiple, specific frequencies. This allows efficient frequency hopping, so that upstreams can avoid frequencies that have known interference and other ingress noise problems.

To configure a spectrum group with a range of frequencies, use the following procedure:

	Command	Purpose
Step 1	Router(config)# <b>configure terminal</b>	Enters configuration mode.
Step 2	Router(config)# <b>cable spectrum-group</b> <i>group-number</i> [ <b>time day hh:mm:ss</b> ] <b>band</b> <i>up-freq1-hz up-freq2-hz</i> [ <i>power-level-dbmV</i> ]	Creates a spectrum group and specifies a range of frequencies that belong to the group.  <i>group-number</i> = Spectrum group number. Valid range is 1 to 32. Configuring a spectrum group with multiple entries of this type, defines a list of frequencies which are available for use as upstream frequencies.  <b>time day hh:mm:ss</b> = (Optional) For scheduled spectrum groups, specifies the day of the week ( <b>Sun—Sat</b> ) and the time of day that the frequency and input power level should change.  <b>band up-freq1-hz up-freq2-hz</b> = Sets the band of frequencies for this spectrum group. The valid range for <i>up-freq1-hz</i> is 5,000,000 Hz to 42,000,000 Hz (DOCSIS) or 5,000,000 Hz to 65,000,000 (EuroDOCSIS), but <i>up-freq2-hz</i> must be greater than <i>up-freq1-hz</i> . (EuroDOCSIS frequencies are supported only on EuroDOCSIS cable interfaces, such as the Cisco uBR-MC16E.)  <i>power-level-dbmV</i> = (Optional) Nominal input power level. Valid range is -10 to +25 decibels per millivolt (dBmV), with a default of 0 dBmV. Some cable plants might want to change only the input power level and not frequency on a daily time schedule.
	<b>Note</b>	When configuring a band of frequencies, specify a band that is 500 KHz larger than the largest desired channel width, to ensure that the largest channel width can still be used when changing the center frequency within the band.
Step 3	Router(config)# <b>interface</b> <i>type slot/port</i>	Configures the interface where: - <i>type</i> = cable - <i>slot</i> = slot number in chassis (slot numbers begin with a 0) - <i>port</i> = port number on cable modem slot (port numbers begin with a 0)
Step 4	Router(config-if)# <b>cable n spectrum-group y</b>	Enters interface configuration mode, and assigns the upstream port to the frequency hop table.
Step 5	Router(config-if)# <b>cable upstream port</b> <b>spectrum group y</b>	Assigns upstream ports individually. Valid only for Cisco uBR-MC16S card.
Step 6	Router(config-if)# <b>exit</b>	Exits configuration mode and force the system to hop.

To configure a spectrum group with multiple fixed frequencies, use the following procedure:

	Command	Purpose
Step 1	Router(config)# <b>configure terminal</b>	Enters configuration mode.
Step 2	Router(config)# <b>cable spectrum-group</b> <i>group-number</i> [ <b>time day hh:mm:ss</b> ] <b>frequency</b> <i>up-freq-hz</i> [ <i>power-level-dbmV</i> ]	Creates a spectrum group and specifies the frequency (or frequencies) that belong to the group.  <i>group-number</i> = Spectrum group number. Valid range is 1 to 32. Configuring a spectrum group with multiple entries of this type, defines a list of frequencies which are available for use as upstream frequencies.  <b>time day hh:mm:ss</b> = (Optional) For scheduled spectrum groups, specifies the day of the week ( <b>Sun—Sat</b> ) and the time of day that the frequency and input power level should change.  <b>frequency up-freq-hz</b> = Specific upstream frequency in Hertz. The valid range is 5,000,000 Hz to 42,000,000 Hz (DOCSIS) or 5,000,000 Hz to 65,000,000 (EuroDOCSIS). (EuroDOCSIS frequencies are supported only on EuroDOCSIS cable interfaces, such as the Cisco uBR-MC16E.)  <i>power-level-dbmV</i> = (Optional) Nominal input power level. Valid range is -10 to +25 decibels per millivolt (dBmV), with a default of 0 dBmV. Some cable plants might want to change only the input power level and not frequency on a daily time schedule.
Step 3	Router(config)# <b>cable spectrum-group</b> <i>group-number</i> [ <b>time hh:mm:ss</b> ] <b>frequency</b> <i>up-freq-hz</i> [ <i>power-level-dbmV</i> ]	Repeat this command to assign multiple specific frequencies to one spectrum group.  <b>Note</b> You must assign a minimum of two frequencies to a spectrum group to enable frequency hopping. If only one frequency is assigned to a spectrum group, no hopping occurs, unless blind hopping has been enabled with the <b>cable upstream hopping blind</b> command.
Step 4	Router(config)# <b>interface</b> <i>type slot/port</i>	Configures the interface where: - <i>type</i> = cable - <i>slot</i> = slot number in chassis (slot numbers begin with a 0) - <i>port</i> = port number on cable modem slot (port numbers begin with a 0)
Step 5	Router(config-if)# <b>cable</b> <i>n</i> <b>spectrum-group</b> <i>y</i>	Enters interface configuration mode, and assigns all the upstream ports on that cable interface to the frequency hop table.
Step 6	Router(config-if)# <b>cable upstream port</b> <b>spectrum group</b> <i>y</i>	Assigns upstream ports individually. Valid only for Cisco uBR-MC16S card.
Step 7	Router(config-if)# <b>exit</b>	Exits configuration mode and force the system to hop.

## Configuring Dynamic Upstream Modulation

To enable the Dynamic Upstream Modulation feature, create at least two modulation profiles then assign them to the appropriate upstream.

	Command	Purpose
Step 1	Router(config)# <b>configure terminal</b>	Enters configuration mode.
Step 2	Router(config)# <b>cable modulation-profile profile [ mix   qam-16   qpsk ]</b>	<p>Creates a modulation profile. A modulation profile is a collection of six burst profiles sent out in a UCD message to configure modem transmit parameters for the upstream message types: request, request data, initial maintenance, station maintenance, short grant, and long grant.</p> <p><i>profile</i> = Modulation profile number (1–8).</p> <p><b>mix</b> = Create a default QPSK/16-QAM mix modulation profile (short and long grant bursts are sent using 16-QAM, while request, request data, initial ranging, and station maintenance bursts are sent using QPSK).</p> <p><b>qam-16</b> = Create a default 16-QAM modulation profile, where all bursts are sent using 16-QAM.</p> <p><b>qpsk</b> = Create a default QPSK modulation profile, where all bursts are sent using QPSK.</p> <p><b>Note</b> Do not use the 16-QAM mode unless you have verified that your cable plant can support that modulation profile. Most cable plants should instead use the <b>mix</b> modulation profile for the primary profile.</p>
Step 3	Router(config)# <b>cable modulation-profile profile [ mix   qam-16   qpsk ]</b>	Repeat this command to create the secondary profile. Typically, the secondary profile is either <b>mix</b> or <b>qpsk</b> .
	<p><b>Note</b> The <b>cable modulation-profile</b> command also supports setting the individual parameters for the initial, long grant, request/data, request, short grant, and station ranging bursts. These parameters, however, should not be modified unless you are thoroughly familiar with how changing each parameter affects the DOCSIS MAC layer. Cisco recommends using the <b>mix</b>, <b>qam-16</b>, and <b>qpsk</b> default modulation profiles for most cable plants.</p>	
Step 4	Router(config)# <b>interface type slot/port</b>	<p>Enters interface configuration mode for the cable interface where:</p> <p><i>type</i> = <b>cable</b></p> <p><i>slot</i> = slot number in chassis for the Cisco uBR-MC16S line card (slot numbers begin with a 0)</p> <p><i>port</i> = port number on cable modem slot (port numbers begin with a 0)</p>
Step 5	Router(config-int)# <b>cable upstream n modulation-profile primary-profile-number secondary-profile-number</b>	<p>Adds the modulation profile to an upstream on the cable interface.</p> <p><i>n</i> = upstream number on cable modem slot (on the Cisco uBR-MC16S, upstream port numbers are 0–5)</p> <p><i>primary-profile-number</i> = The primary modulation profile added to the interface.</p> <p><i>secondary-profile-number</i> = The secondary modulation profile added to the interface.</p>
Step 6	Router(config-int)# <b>cable upstream n modulation-profile primary-profile-number secondary-profile-number</b>	Repeat this command up to five times to configure the six upstreams on the Cisco uBR-MC16S line card.
Step 7	Router(config-int)# <b>exit</b>	Enter <b>exit</b> to go back to the configuration mode.

## Configuring Proactive Channel Management

To optimize the spectrum management behavior for your plant’s specific characteristics, you can customize the following parameters:

- Optionally specify the priority of the corrective actions to be taken when noise on an upstream exceeds the threshold for its modulation profile.
- Optionally configure the CNR threshold and FEC values for the upstream and its two modulation profiles.
- Optionally specify the allowable range of channel widths that can be used if frequency hopping and modulation switching cannot find a clean upstream without noise problems.

	Command	Purpose
Step 1	Router(config)# <b>configure terminal</b>	Enters configuration mode.
Step 2	Router(config)# <b>interface</b> <i>type slot/port</i>	Configures the interface where: <i>type</i> = cable <i>slot</i> = slot number in chassis (slot numbers begin with a 0) <i>port</i> = port number on cable modem slot (port numbers begin with a 0)
Step 3	<b>cable upstream</b> <i>n</i> <b>hop-priority</b> <b>frequency modulation channel-width</b> or <b>cable upstream</b> <i>n</i> <b>hop-priority modulation frequency channel-width</b> or <b>cable upstream</b> <i>n</i> <b>hop-priority frequency channel-width modulation</b>	(Optional) Specifies the priority of the three types of corrective actions to be taken.  <i>n</i> = upstream number on cable modem slot (on the Cisco uBR-MC16S, upstream port numbers are 0–5)  The three parameters ( <b>modulation</b> , <b>frequency</b> , and <b>channel-width</b> ) specify the order of the corrective actions to be taken when the noise for the upstream exceeds the threshold specified for the current modulation profile. When setting the allowable parameters, the <b>channel-width</b> option must always appear after the <b>frequency</b> option.
Step 4	<b>cable upstream</b> <i>n</i> <b>threshold</b> <b>cnr-profile1 threshold1-in-dB cnr-profile2 threshold2-in-dB corr-fec fec-corrected uncorr-fec fec-uncorrected</b>	(Optional) Specify the CNR threshold and FEC values for the upstream and its two modulation profiles.  <i>n</i> = upstream number on cable modem slot (on the Cisco uBR-MC16S, upstream port numbers are 0–5)  <b>cnr-profile1 threshold1-in-dB</b> = CNR threshold for the primary modulation profile (5-35 dB, with a default of 25)  <b>cnr-profile2 threshold1-in-dB</b> = CNR threshold for the secondary modulation profile (5-35 dB, must be less than that for the primary modulation profile, with a default of 15)  <b>corr-fec fec-corrected</b> = FEC corrected threshold as a percentage of total packets on the upstream (3-20%, with a default of 3%)  <b>uncorr-fec fec-uncorrected</b> = FEC uncorrected threshold as a percentage of total packets on the upstream (1-10%, with a default of 1%)

	Command	Purpose
Step 5	<code>cable upstream n channel-width width1 width2</code>	<p>(Optional) Specify the range of channel widths to scan when ingress noise conditions require changing the channel width.</p> <p><b>channel-width width1 width2</b> = the range of channel widths. Valid values are 200000 Hz (160 kilosymbols per second [ksp/s]), 400000 Hz (320 ksp/s), 800000 Hz (640 ksp/s), 1600000 Hz (1280 ksp/s), and 3200000 Hz (2560 ksp/s), where <i>width1</i> specifies the default upstream channel width, and <i>width2</i> specifies the last allowable (minimum) channel width; <i>width2</i> must be smaller than <i>width1</i>.</p> <p>The default is a single channel width of 1600000 Hz.</p> <p><b>Note</b> When the Cisco uBR-MC16S card determines it must change the channel width to adjust to noise problems, it starts at the initial channel width (<i>width1</i>) and cuts it in half until it either finds a clean channel or until it reaches the minimum channel width (<i>width2</i>).</p>
Step 6	<code>Router(config-int)# exit</code>	Enter <b>exit</b> to go back to the configuration mode.

## Verifying the Spectrum Management Configuration

- Step 1** Enter the **show running-config** command at the Router# prompt to check the value of the settings you have entered.
- ```
Router# show running-config
```
- To review changes you make to the configuration, use the **show startup-config** command to display the information stored in NVRAM.
- Step 2** Use the **show cable modulation-profile** privileged EXEC command to display modulation profile group information.
- ```
Router# show cable modulation-profile [profile] [iuc-code]
```
- profile*—(Optional) Profile number (1–8).
- iuc-code*—(Optional) Internal usage code (IUC). Valid options are:
- **initial**—initial ranging burst
  - **long**—long grant burst
  - **request**—request burst
  - **reqdata**—request data burst
  - **short**—short grant burst
  - **station**—station ranging burst
- Step 3** Use the **show controllers cable upstream** command to display the status and configuration of each upstream. The following example shows the display for the first two upstreams on a Cisco uBR-MC16S line card:
- ```
CMTS# show controllers c6/0 upstream
Cable6/0 Upstream 0 is administratively down
Frequency not set, Channel Width 1.600 MHz, QPSK Symbol Rate 1.280 Msps
```

```

Spectrum Group is unassigned
CNR - Unknown - no modems online.
Nominal Input Power Level 0 dBmV, Tx Timing Offset 0
Ranging Backoff automatic (Start 0, End 3)
Ranging Insertion Interval automatic (60 ms)
Tx Backoff Start 0, Tx Backoff End 4
Modulation Profile Group 1
Concatenation is enabled
Fragmentation is enabled
part_id=0x3137, rev_id=0x03, rev2_id=0xFF
nb_agc_thr=0x0000, nb_agc_nom=0x0000
Range Load Reg Size=0x58
Request Load Reg Size=0x0E
Minislot Size in number of Timebase Ticks is = 8
Minislot Size in Symbols = 64
Bandwidth Requests = 0x0
Piggyback Requests = 0x0
Invalid BW Requests= 0x0
Minislots Requested= 0x0
Minislots Granted = 0x0
Minislot Size in Bytes = 16
Map Advance (Dynamic) : 2180 usecs
UCD Count = 0
DES Ctrl Reg#0 = C000C043, Reg#1 = 0
Cable6/0 Upstream 1 is up
  Frequency 25.008 MHz, Channel Width 1.600 MHz, 16-QAM Symbol Rate 1.280 Msps
  Spectrum Group 1, Last Frequency Hop Data Error: NO(0)
  MC16S CNR measurement - 45 dB
  Nominal Input Power Level 0 dBmV, Tx Timing Offset 2811
  Ranging Backoff automatic (Start 0, End 3)
  Ranging Insertion Interval automatic (60 ms)
  Tx Backoff Start 0, Tx Backoff End 4
  Modulation Profile Group 1
  Concatenation is enabled
  Fragmentation is enabled
  part_id=0x3137, rev_id=0x03, rev2_id=0xFF
  nb_agc_thr=0x0000, nb_agc_nom=0x0000
  Range Load Reg Size=0x58
  Request Load Reg Size=0x0E
  Minislot Size in number of Timebase Ticks is = 8
  Minislot Size in Symbols = 64
  Bandwidth Requests = 0x12
  Piggyback Requests = 0x5
  Invalid BW Requests= 0x0
  Minislots Requested= 0xFA
  Minislots Granted = 0xFA
  Minislot Size in Bytes = 32
  Map Advance (Dynamic) : 2454 usecs
  UCD Count = 230
  DES Ctrl Reg#0 = C000C043, Reg#1 = 0
  Dynamic Services Stats:
  DSA: 0 REQs 0 RSPs 0 ACKs
  0 Successful DSAs 0 DSA Failures
  DSC: 0 REQs 0 RSPs 0 ACKs
  0 Successful DSCs 0 DSC Failures
  DSD: 0 REQs 0 RSPs
  0 Successful DSDs 0 DSD Failures

  DCC: 0 REQs 0 RSPs 0 ACKs
  0 Successful DCCs 0 DCC Failures
CMTS#

```



**Note**

In the above example, upstream 0 displays “CNR - Unknown - no modems online” to indicate that the CNR value has not yet been calculated because no cable modems have come online on that particular upstream yet.

**Step 4** To display the hop period and hop threshold values for each upstream, use the **show cable hop** command:

```
CMTS# show cable hop
Upstream Port Poll Missed Min Missed Hop Hop Corr Uncorr
Port Status Rate Poll Poll Sample Pcnt Thres Period FEC FEC
(ms) Count Sample Pcnt Pcnt (sec) Errors Errors
Cable3/0/U0 20.800 Mhz 105 0 20 0% 25% 45 1 4
Cable3/0/U1 20.800 Mhz 105 0 48 0% 25% 45 2 19
Cable3/0/U2 23.120 Mhz 105 0 45 0% 25% 45 0 5
Cable3/0/U3 22.832 Mhz 105 0 26 0% 25% 45 0 6
Cable3/0/U4 22.896 Mhz 105 0 43 0% 25% 45 0 7
Cable3/0/U5 23.040 Mhz 105 0 54 0% 25% 45 1 3
Cable4/0/U0 22.896 Mhz 117 0 26 0% 25% 45 0 2
Cable4/0/U1 23.168 Mhz 117 0 87 0% 25% 45 4 2
Cable4/0/U2 22.896 Mhz 117 0 23 0% 25% 45 1 0
Cable4/0/U3 20.800 Mhz 117 0 54 0% 25% 45 0 0
Cable4/0/U4 22.928 Mhz 117 0 22 0% 25% 45 0 1
Cable4/0/U5 22.960 Mhz 117 0 0 ---- 25% 45 0 0
CMTS#
```

**Step 5** Use the **show cable spectrum-group** command to display the assignment of each spectrum group:

```
CMTS# show cable spectrum-group
Group Frequency Upstream Weekly Scheduled Power Shared
No. Band Port Availability Level Spectrum
(Mhz) From Time: To Time: (dBmV)
1 20.000-21.600 0 No
1 22.000-24.000 0 No
1 20.784 [1.60] Cable3/0 U0 0
1 20.784 [1.60] Cable3/0 U1 0
1 23.120 [1.60] Cable3/0 U2 0
1 22.832 [1.60] Cable3/0 U3 0
1 22.896 [1.60] Cable3/0 U4 0
1 23.024 [1.60] Cable3/0 U5 0
1 23.152 [1.60] Cable4/0 U1 0
1 22.896 [1.60] Cable4/0 U0 0
1 22.896 [1.60] Cable4/0 U2 0
1 20.784 [1.60] Cable4/0 U3 0
1 22.928 [1.60] Cable4/0 U4 0
1 22.960 [1.60] Cable4/0 U5 0
```

**Step 6** Use the **show cable modem cnr** command to display the current CNR value for a particular cable modem:

```
CMTS# show cable modem 10.240.179.234 cnr
MAC Address IP Address I/F MAC Prim CNR
State Sid (db)
0020.40bc.3588 10.240.179.234 C3/0/U2 online 2 38.0
CMTS# show cable modem 10.240.179.51 cnr
MAC Address IP Address I/F MAC Prim CNR
State Sid (db)
0020.40ef.4be0 10.240.179.51 C3/0/U5 online 11 39.5
CMTS#
```

# Monitoring Spectrum Management

You can use both the Cisco IOS CLI and SNMP managers to monitor the Cisco uBR-MC16S Spectrum Management Feature Enhancements. The DOCSIS Cable Modem Test Analyzer (DCMTA), available from Acterna Corporation, also provides a graphical interface for live troubleshooting of an individual upstream or cable modem.

## Using CLI Commands

The following commands provide information on the spectrum condition of an upstream:

| Command                                                                                                                                 | Purpose                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router# <b>show cable modem</b> [ <i>ip-address</i>   <i>interface</i>   <i>mac-address</i> ] [ <i>options</i> ]                        | Displays information, including CNR values, for the registered and unregistered cable modems. See <a href="#">show cable modem, page 41</a> .                                            |
| Router# <b>show cable spectrum-group</b> [ <i>groupnum</i> ] [ <b>detail</b> ]                                                          | Displays information about the spectrum groups that have been configured. See <a href="#">show cable spectrum-group, page 47</a> .                                                       |
| Router# <b>show controllers cable x/y upstream n</b> [ <i>ip-address</i>   <i>mac-address</i> ] [ <i>start-freq end-freq res-freq</i> ] | Displays the noise levels for a particular cable modem, or displays the background noise for an entire upstream. See <a href="#">show controllers cable upstream spectrum, page 50</a> . |

## Using SNMP

SNMP can also be used to monitor the spectrum on each upstream on the Cisco uBR-MC16S line card. The CISCO-CABLE-SPECTRUM-MIB MIB has been enhanced to provide the following MIB attributes:

- [ccsSNRRRequestTable, page 16](#)
- [ccsSpectrumRequestTable, page 17](#)
- [ccsSpectrumDataTable, page 18](#)
- [ccsUpSpecMgmtTable, page 18](#)
- [ccsHoppingNotification, page 19](#)

### ccsSNRRRequestTable

[Table 2](#) lists the attributes in the `ccsSNRRRequestTable`, which contains the CNR measurements that are made for individual cable modems on an upstream:

**Table 2** *ccsSNRRRequestTable Attributes*

| Attribute                          | Type       | Description                                                     |
|------------------------------------|------------|-----------------------------------------------------------------|
| <code>ccsSNRRRequestIndex</code>   | Integer32  | Arbitrary index to unique identify each table entry.            |
| <code>ccsSNRRRequestMacAddr</code> | MacAddress | MAC address of the remote online cable modem being reported on. |

**Table 2** *ccsSNRRequestTable Attributes (continued)*

| Attribute                | Type                | Description                                                                                                                                   |
|--------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| ccsSNRRequestSNR         | Integer32           | SNR value, in dB, that has been measured. This value is 0 when the Operation State is "running."                                              |
| ccsSNRRequestOperation   | CCSRequestOperation | Sets the current operation: start, pending, running, or abort.                                                                                |
| ccsSNRRequestOperState   | CCSRequestOperState | Reports on the current operation state: idle, pending, running, noError, aborted, notOnLine, invalidMac, timeOut, fftBusy, fftFailed, others. |
| ccsSNRRequestStartTime   | TimeStamp           | Contains the time when the SNR measurement operation starts.                                                                                  |
| ccsSNRRequestStoppedTime | TimeStamp           | Contains the time when the SNR measurement stops.                                                                                             |
| ccsSNRRequestStatus      | RowStatus           | Controls the modification, creation, and deletion of table entries.                                                                           |

## ccsSpectrumRequestTable

**Table 3** lists the attributes for each entry in the `ccsSpectrumRequestTable` table, which is used to obtain the spectrum profile for a particular cable modem or to obtain the background SNR for an entire upstream:

**Table 3** *ccsSpectrumRequestTable Attributes*

| Attribute                     | Type                 | Description                                                                                                                                   |
|-------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| ccsSpectrumRequestIndex       | Integer32            | Arbitrary index to unique identify each table entry.                                                                                          |
| ccsSpectrumRequestIfIndex     | InterfaceIndexOrZero | Interface identifying the upstream                                                                                                            |
| ccsSpectrumRequestMacAddr     | MacAddress           | MAC address to specify an SNR value for a particular cable modem, or 0000.0000.0000 to indicate that background noise for the entire spectrum |
| ccsSpectrumRequestUpperFreq   | CCSFrequency         | Upper frequency for the frequency range to be monitored (5000 to 42000 KHz, with a default of 42000 KHz)                                      |
| ccsSpectrumRequestLowFreq     | CCSFrequency         | Lower frequency (in KHz) for the frequency range to be monitored (5000 to 42000 KHz, with a default of 5000 KHz)                              |
| ccsSpectrumRequestResolution  | Integer32            | Requested resolution to determine how the frequency range should be sampled (12 to 37000 KHz, with a default of 60 KHz)                       |
| ccsSpectrumRequestStartTime   | TimeStamp            | Time when the spectrum measurement began                                                                                                      |
| ccsSpectrumRequestStoppedTime | TimeStamp            | Time when the spectrum measurement completed                                                                                                  |

**Table 3** *ccsSpectrumRequestTable Attributes (continued)*

| Attribute                   | Type                | Description                                                               |
|-----------------------------|---------------------|---------------------------------------------------------------------------|
| ccsSpectrumRequestOperation | CCSRequestOperation | Starts a new spectrum management request or aborts the current one        |
| ccsSpectrumRequestOperState | CCSRequestOperState | Provides the operational state of the current spectrum management request |
| ccsSpectrumRequestStatus    | RowStatus           | Controls the modification, creation, and deletion of table entries.       |

## ccsSpectrumDataTable

[Table 4](#) lists the attributes in each entry of the `ccsSpectrumDataTable` table, which contains the results for a spectrum request:

**Table 4** *ccsSpectrumDataTable Attributes*

| Attribute            | Type                 | Description                                                      |
|----------------------|----------------------|------------------------------------------------------------------|
| ccsSpectrumDataFreq  | CCSMeasuredFrequency | Frequency in KHz for which this power measurement was made       |
| ccsSpectrumDataPower | INTEGER              | Measured received power for the given frequency (-50 to 50 dBmV) |



### Note

The `ccsSpectrumRequestTable` and `ccsSpectrumDataTable` tables provide the same information as that provided by the [show controllers cable upstream spectrum](#) command.

## ccsUpSpecMgmtTable

[Table 5](#) lists the attributes in the `ccsUpSpecMgmtTable` table, which provides an entry describing each frequency hop:

**Table 5** *ccsUpSpecMgmtEntry Attributes*

| Attribute                | Type      | Description                                                                                                                                                                                                   |
|--------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ccsUpSpecMgmtHopPriority | INTEGER   | Specifies the priority of frequency, modulation profile, and channel width in determining corrective action for excessive noise on the upstream (default is frequency, modulation profile, and channel width) |
| ccsUpSpecMgmtSnrThres1   | Integer32 | Specifies the upper SNR threshold for modulation profile 1 (5–35 dB, default of 25)                                                                                                                           |
| ccsUpSpecMgmtSnrThres2   | Integer32 | Specifies the upper SNR threshold for modulation profile 2 (5–35 dB, default of 15, and must be lower than that specified for <code>ccsUpSpecMgmtSnrThres1</code> )                                           |

**Table 5** *ccsUpSpecMgmtEntry Attributes (continued)*

| Attribute                       | Type         | Description                                                                                           |
|---------------------------------|--------------|-------------------------------------------------------------------------------------------------------|
| ccsUpSpecMgmtFecCorrectThres1   | Integer32    | Specifies the FEC correctable error threshold for modulation profile 1 (1–20%)                        |
| ccsUpSpecMgmtFecCorrectThres2   | Integer32    | Deprecated and no longer used.                                                                        |
| ccsUpSpecMgmtFecUnCorrectThres1 | Integer32    | Specifies the FEC uncorrectable error threshold for modulation profile 1 (1–20%)                      |
| ccsUpSpecMgmtFecUnCorrectThres2 | Integer32    | Deprecated and no longer used.                                                                        |
| ccsUpSpecMgmtSnrPollPeriod      | Integer32    | Deprecated and no longer used.                                                                        |
| ccsUpSpecMgmtHopCondition       | INTEGER      | Reports the condition that triggers a frequency hop (SNR value or percentage of modems going offline) |
| ccsUpSpecMgmtFromCenterFreq     | CCSFrequency | Provides the center frequency (in KHz) before the latest frequency hop                                |
| ccsUpSpecMgmtToCenterFreq       | CCSFrequency | Provides the current center frequency (in KHz) after the latest frequency hop                         |
| ccsUpSpecMgmtFromBandWidth      | CCSFrequency | Provides the channel width (in KHz) before the latest frequency hop                                   |
| ccsUpSpecMgmtToBandWidth        | CCSFrequency | Provides the current channel width (in KHz) after the latest frequency hop                            |
| ccsUpSpecMgmtFromModProfile     | Integer32    | Provides the modulation profile number before the latest frequency hop                                |
| ccsUpSpecMgmtToModProfile       | Integer32    | Provides the current modulation profile number after the latest frequency hop                         |
| ccsUpSpecMgmtSNR                | Integer32    | Provides the current SNR value (in dB) for the upstream                                               |

## ccsHoppingNotification

[Table 6](#) describes the attributes contained in the notification that is sent after each frequency hop:

**Table 6** *ccsHoppingNotification Attributes*

| Attribute                   | Type         | Description                                                                                           |
|-----------------------------|--------------|-------------------------------------------------------------------------------------------------------|
| ccsUpSpecMgmtHopCondition   | INTEGER      | Reports the condition that triggers a frequency hop (SNR value or percentage of modems going offline) |
| ccsUpSpecMgmtFromCenterFreq | CCSFrequency | Provides the center frequency (in KHz) before the latest frequency hop                                |
| ccsUpSpecMgmtToCenterFreq   | CCSFrequency | Provides the current center frequency (in KHz) after the latest frequency hop                         |
| ccsUpSpecMgmtFromBandWidth  | CCSFrequency | Provides the channel width (in KHz) before the latest frequency hop                                   |
| ccsUpSpecMgmtToBandWidth    | CCSFrequency | Provides the current channel width (in KHz) after the latest frequency hop                            |

Table 6 *ccsHoppingNotification Attributes (continued)*

| Attribute                   | Type      | Description                                                                   |
|-----------------------------|-----------|-------------------------------------------------------------------------------|
| ccsUpSpecMgmtFromModProfile | Integer32 | Provides the modulation profile number before the latest frequency hop        |
| ccsUpSpecMgmtToModProfile   | Integer32 | Provides the current modulation profile number after the latest frequency hop |

## Using the DOCSIS Cable Modem Test Analyzer

The DOCSIS Cable Modem Test Analyzer (DCMTA) is a software tool that provides spectrum analyzer capability on the Cisco uBR7200 series CMTS for troubleshooting problems with an individual upstream port or an individual cable modem. The DCMTA works together with the Cisco uBR-MC16S line card on a Cisco uBR7200 series CMTS running Cisco IOS release 12.1(7)CX1 to display the return path spectral information from the line card and its related ports.

The DCMTA software uses SNMP requests to obtain the spectrum data from the CISCO-CABLE-SPECTRUM-MIB and displays this data in a graphical interface. The DCMTA software runs on a Windows PC and supports simultaneous client access to a single and multiple CMTS routers, upstreams, and cable modems. The software and its Windows PC can be located anywhere in your network that offers connectivity with the Cisco uBR7200 series CMTS.

The DCMTA software provides the ability to perform real-time diagnosis of the return path, as well as live troubleshooting of an upstream port or individual cable modem. The software uses simple menus and interactive screens, allowing users to analyze the return path performance in real time as problems occur. The software offers multiple views of the spectrum management data, providing a flexible interface for isolating, characterizing, and diagnosing problems, so that technicians can make intelligent decisions about how to respond to problems in the return path.



### Tip

For more information about the DCMTA software, contact Acterna Corporation. In North America, call 1-800-638-2049 or +1-301-353-1550 (20400 Observation Drive, Germantown, MD, USA 20876-4023). For other locations, see their web site at <http://www.acterna.com>.

Follow these guidelines when using the DCMTA software tool:

- Configure matching SNMP community strings on the Cisco uBR7200 series CMTS and DCMTA software tool so that the DCMTA software can obtain the spectrum management data using SNMP requests. On the Cisco uBR7200 series CMTS, this requires the minimum following CLI commands:
  - **snmp manager**
  - **snmp-server engineID local *engine-id***
  - **snmp-server community *community-string* RW**
  - **snmp-server trap-source *interface-providing-access-to-DCMTA-PC***
  - **snmp-server enable traps cable hopping**

Because the DCMTA software requires SNMP read-write access, Cisco also recommends setting up an access list that restricts SNMP read-write access to the IP address for the particular PC that is running the DCMTA software.

- The DCMTA software should be used for live troubleshooting of specific problems in the return path. Do not use DCMTA for ongoing monitoring because it requests a large volume of data for each SNMP request, and constant use could affect network bandwidth and the overall performance of the Cisco uBR7200 series CMTS. For best results, the DCMTA software should be launched when needed and then exited after the return path problem has been resolved.
- Because the DCMTA software uses SNMP polling to obtain the spectrum management data, its graphical displays show a digital representation that appears more jagged than the analog swept spectrum displays that are generated by hardware spectrum analyzers.
- When monitoring individual cable modems, the DCMTA graphical displays could show the cable modem missing for several seconds, even though the cable modem is still connected and online. This can happen for two reasons:
  - The DOCSIS specification allows a CMTS to periodically miss a ranging burst from a cable modem without affecting the cable modem's connectivity. If this occurs while the DCMTA software is monitoring a particular cable modem, the graphical display could show that cable modem missing for several seconds.
  - The DCMTA software uses SNMP requests to obtain its spectrum management data. Because SNMP is based on the connectionless UDP protocol, it is possible that SNMP packets can be dropped or lost by the routers and other network devices between the Cisco uBR7200 series CMTS and DCMTA PC. If this happens, the graphical display could show a drop in the spectrum that was described by the data that was contained in the lost packets.

In both of these cases, the missing spectrum data should reappear quickly, within several seconds. If it does, and if no further problems occur with that particular cable modem or spectrum, then the problem is likely due to the transient network problems described above.

## Configuration Example

This section provides a typical configuration example for a Cisco uBR7200 series router using the Cisco uBR-MC16S cable interface line card. This configuration does the following:

- Creates three spectrum groups with different frequency bands, hop periods, and hop thresholds.
- Creates two upstream modulation profiles, one for QPSK operation and one for 16-QAM operation by specifying the parameters for each burst type.
- Creates two upstream modulation profiles, one for QPSK operation and one for mixed QPSK/16-QAM operation, using the default profile options (**qpsk** and **mix**).
- Configures one upstream (port 5) on cable interface 3/0 to use spectrum group 3.
- Configures the upstreams with the primary modulation profile set to mixed QPSK/16-QAM operation and the secondary modulation profile set for QPSK operation.
- Configures the upstream so that when its noise threshold is reached, it first attempts to change the frequency, then the channel-width, and finally to switch the modulation profile (using the Dynamic Upstream Modulation feature).

```
!
version 12.1
no service pad
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
hostnameubr7200
!
```

```

!
! Define a frequency band for a 1.6 MHz channel around center frequency of 20.800 MHz
cable spectrum-group 1 band 19750000 21850000 0
! Define a frequency band for a 1.6 MHz channel around center frequency of 23.200 MHz
cable spectrum-group 1 band 22150000 24250000 0
! Hop period set to 30 sec to avoid modems going offline before initiating a hop priority
cable spectrum-group 1 hop period 30
! Percentage of missed station maintenance from modems
cable spectrum-group 1 hop threshold 20
!
cable modulation-profile 1 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16

! Create second modulation profile numbered 4
cable modulation-profile 4 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw16
cable modulation-profile 4 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 4 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 4 short 6 75 6 8 16qam scrambler 152 no-diff 144 shortened uw8
cable modulation-profile 4 long 8 220 0 8 16qam scrambler 152 no-diff 160 shortened uw8

! Create two modulation profiles using the default QPSK and QPSK/16-QAM profiles
cable modulation-profile 3 qpsk
cable modulation-profile 5 mix
!
no cable qos permission create
no cable qos permission update
cable qos permission modems
cable time-server
clock calendar-valid
no ip subnet-zero
no ip domain-lookup
!
!
!
interface FastEthernet0/0
no ip address
no ip mroute-cache
shutdown
media-type MII
full-duplex
!
interface Ethernet1/0
ip address 10.11.10.1 255.0.0.0
no ip mroute-cache
half-duplex
!

interface Cable3/0
ip address 192.168.100.23 255.255.255.0
ip address 192.168.101.12 255.255.255.0 secondary
no keepalive
cable map-advance static
cable bundle 1 master
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 687000000
! Assign upstream to spectrum group
cable upstream 0 spectrum-group 1
! Set channel-width to be fixed at 1.6 MHz
cable upstream 0 channel-width 1600000 1600000
! Set priority of corrective actions
cable upstream 0 hop-priority frequency channel-width modulation
! Set the thresholds for corrective action

```

```

cable upstream 0 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
! Assign modulation profiles to upstream port in order of preference
cable upstream 0 modulation-profile 5 1
no cable upstream 0 concatenation
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 1
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 hop-priority frequency channel-width modulation
cable upstream 1 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 1 modulation-profile 5 1
no cable upstream 1 concatenation
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 1
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 hop-priority frequency channel-width modulation
cable upstream 2 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 2 modulation-profile 5 1
no cable upstream 2 concatenation
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 1
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 hop-priority frequency channel-width modulation
cable upstream 3 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 3 modulation-profile 5 1
no cable upstream 3 concatenation
no cable upstream 3 shutdown
cable upstream 4 spectrum-group 1
cable upstream 4 channel-width 1600000 1600000
cable upstream 4 hop-priority frequency channel-width modulation
cable upstream 4 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 4 modulation-profile 5 1
no cable upstream 4 concatenation
no cable upstream 4 shutdown
cable upstream 5 spectrum-group 1
cable upstream 5 channel-width 1600000 1600000
cable upstream 5 hop-priority frequency channel-width modulation
cable upstream 5 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 5 modulation-profile 5 1
no cable upstream 5 concatenation
no cable upstream 5 shutdown
no cable dci-response
cable dhcp-giaddr policy
!
interface Cable4/0
no ip address
no keepalive
cable map-advance static
cable bundle 1
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 687000000
cable upstream 0 spectrum-group 1
cable upstream 0 channel-width 1600000 1600000
cable upstream 0 hop-priority frequency channel-width modulation
cable upstream 0 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 0 modulation-profile 5 1
no cable upstream 0 concatenation
no cable upstream 0 shutdown
cable upstream 1 spectrum-group 1
cable upstream 1 channel-width 1600000 1600000
cable upstream 1 hop-priority frequency channel-width modulation
cable upstream 1 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 1 modulation-profile 5 1

```

```

no cable upstream 1 concatenation
no cable upstream 1 shutdown
cable upstream 2 spectrum-group 1
cable upstream 2 channel-width 1600000 1600000
cable upstream 2 hop-priority frequency channel-width modulation
cable upstream 2 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 2 modulation-profile 5 1
no cable upstream 2 concatenation
no cable upstream 2 shutdown
cable upstream 3 spectrum-group 1
cable upstream 3 channel-width 1600000 1600000
cable upstream 3 hop-priority frequency channel-width modulation
cable upstream 3 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 3 modulation-profile 5 1
no cable upstream 3 concatenation
no cable upstream 3 shutdown
cable upstream 4 spectrum-group 1
cable upstream 4 channel-width 1600000 1600000
cable upstream 4 hop-priority frequency channel-width modulation
cable upstream 4 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 4 modulation-profile 5 1
no cable upstream 4 concatenation
no cable upstream 4 shutdown
cable upstream 5 spectrum-group 1
cable upstream 5 channel-width 1600000 1600000
cable upstream 5 hop-priority frequency channel-width modulation
cable upstream 5 threshold cnr-profile1 23 cnr-profile2 15 Corr-Fec 5 Uncorr-Fec 1
cable upstream 5 modulation-profile 5 1
no cable upstream 5 concatenation
no cable upstream 5 shutdown
no cable dci-response
cable dhcp-giaddr primary
!
ip default-gateway 10.11.0.1
ip classless
ip route 10.11.254.254 255.255.255.255 10.11.0.1
no ip http server
!
!
snmp-server engineID local 0000000902000D0CAA7BB00
snmp-server community private RW
snmp-server trap-source FastEthernet0/0
snmp-server packetsize 2048
snmp-server system-shutdown
snmp-server enable traps cable hopping
snmp-server manager
!
!
line con 0
  exec-timeout 0 0
  transport input none
line aux 0
line vty 0 4
  no login
!
end

```

# Command Reference

This section documents commands that are new or modified in Cisco IOS Release 12.1(7)CX1. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

The following new and modified commands are documented:

- [cable modulation-profile](#), page 26
- [cable spectrum-group hop period](#), page 29
- [cable spectrum-group hop threshold](#), page 31
- [cable upstream hop-priority](#), page 34
- [cable upstream modulation-profile](#), page 36
- [cable upstream threshold](#), page 39
- [show cable modem](#), page 41
- [show cable spectrum-group](#), page 47
- [show controllers cable upstream spectrum](#), page 50

**Note**

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For complete information about all cable-related commands, see the *Cisco Broadband Cable and Fixed Wireless Command Reference Guide*, available on Cisco.com and the customer documentation CD-ROM.

---

# cable modulation-profile

To define the modulation profile, use the **cable modulation-profile** command in global configuration mode. Use the **no** form of this command to remove the entire modulation profile or to reset a particular burst to its default values.

**cable modulation-profile** *profile* [ **mix** | **qam-16** | **qpsk** ]

**cable modulation-profile** *profile iuc fec-tbytes fec-len burst-len guard-t mod scrambler seed diff pre-len last-cw uw-len*

**no cable modulation-profile** *profile* [ *iuc* | **mix** | **qam-16** | **qpsk** ]

| Syntax Description |  |                                                                                                                                                                                                                                                                             |
|--------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>profile</i>     |  | Modulation profile number (1–8).                                                                                                                                                                                                                                            |
| <b>mix</b>         |  | Create a default QPSK/16-QAM mix modulation profile where short and long grant bursts are sent using 16-QAM, while request, initial ranging, and station maintenance bursts are sent using QPSK). The burst parameters are set to their default values for each burst type. |
| <b>qam-16</b>      |  | Create a default 16-QAM modulation profile, where all bursts are sent using 16-QAM. The burst parameters are set to their default values for each burst type.                                                                                                               |
| <b>qpsk</b>        |  | Create a default QPSK modulation profile, where all bursts are sent using QPSK. The burst parameters are set to their default values for each burst type.                                                                                                                   |
| <i>iuc</i>         |  | Interval usage code. Valid entries are: <b>initial</b> , <b>long</b> , <b>request</b> , <b>reqdata</b> , <b>short</b> , or <b>station</b> .                                                                                                                                 |
| <i>fec-tbytes</i>  |  | The number of bytes that can be corrected per FEC code word. Valid values are from 0 to 10, where 0 means no FEC.                                                                                                                                                           |
| <i>fec-len</i>     |  | FEC code word length. Valid values are from 16 to 253.                                                                                                                                                                                                                      |
| <i>burst-len</i>   |  | Maximum burst length in minislots. Valid values are from 0 to 255, where 0 means no limit.                                                                                                                                                                                  |
| <i>guard-t</i>     |  | Guard time in symbols. The time between successive bursts.                                                                                                                                                                                                                  |
| <i>mod</i>         |  | Modulation. Valid entries are <b>16qam</b> and <b>qpsk</b> .                                                                                                                                                                                                                |
| <i>scrambler</i>   |  | Enable or disable scrambler. Valid entries are <b>scrambler</b> and <b>no-scrambler</b> .                                                                                                                                                                                   |
| <i>seed</i>        |  | Scrambler seed in hexadecimal format. Valid values are from 0x0000 to 0x7FFF.                                                                                                                                                                                               |
| <i>diff</i>        |  | Enable or disable differential encoding. Valid entries are <b>diff</b> and <b>no-diff</b> .                                                                                                                                                                                 |
| <i>pre-len</i>     |  | Preamble length in bits. Valid values are from 2 to 128.                                                                                                                                                                                                                    |
| <i>last-cw</i>     |  | Handling of FEC for last code word. Valid entries are <b>fixed</b> for fixed code-word length and <b>shortened</b> for shortened last code word.                                                                                                                            |
| <i>uw-len</i>      |  | Upstream unique word length. Enter <b>uw8</b> for 8-bit unique words or <b>uw16</b> for 16-bit unique code words.                                                                                                                                                           |

## Defaults

Modulation profile #1 with **qpsk** option.

**Command Modes** Global configuration

| Command History | Release                   | Modification                                                         |
|-----------------|---------------------------|----------------------------------------------------------------------|
|                 | 11.3 NA                   | This command was introduced.                                         |
|                 | 12.0(7)XR2                | This command was supported.                                          |
|                 | 12.0(6)SC and 12.1(3a)EC1 | The <b>mix</b> , <b>qpsk</b> , and <b>qam-16</b> options were added. |

**Usage Guidelines** A modulation profile is a collection of six burst profiles that are sent out in an Upstream Channel Descriptor (UCD) message to configure a modem's transmit parameters for the following upstream message types: request, request data, initial maintenance, station maintenance, short grant, and long grant.

You can use the **no cable modulation-profile** command to remove all modulation profiles except modulation profile 1. In the case of modulation profile 1, the **no cable modulation-profile** command sets all of the parameters in a burst to default values.

To use this command correctly, enter a line with all parameters for each upstream burst type. Each burst type should be fully specified. An incomplete burst profile causes unreliable operation, or loss of modem connectivity.



**Caution**

Changes to modulation profiles causes changes to the physical layer. Because changing physical layer characteristics affects router performance and function, this task should be reserved for expert users who have a thorough understanding of DOCSIS systems and how each parameter affects the network.

Three default profiles are available that can be used to quickly create modulation profiles, without having to specify the parameters for each individual burst: **mix**, **qpsk**, and **qam-16**. The burst parameters for the request, initial, station maintenance, short, and long bursts are set to their default values for each burst type. The reqdata burst type is not created when using the default modulation profiles.

The default profiles allow basic profiles to be implemented for initial network connectivity. As the characteristics of a cable plant become better known, the profiles can then be adjusted accordingly.



**Note**

Do not use the **qam-16** mode unless you have verified that your cable plant can support that modulation profile. Most cable plants should instead use the **mix** modulation profile for the primary profile.

Turning the scrambler off can cause packet loss and is used only in lab testing environments.

Errors or incompatible configurations in the burst profiles cause modems to either drop connectivity, drop short or long data packets, or even to fail to connect to the network. It is possible to build a burst profile set for which no implementation of a DOCSIS receiver is capable of receiving the modem's transmission.

160 Ksymbol/sec and 2560 Ksymbol/sec data rates are highly sensitive to unique word length, preamble length, and FEC sizing. Incorrect choices for these values can cause poor, or no, connectivity at these symbol rates.

## Examples

The following example shows how to create a mixed modulation profile, using 16-QAM for the short and long grant bursts and QPSK for the request, initial ranging, and station maintenance bursts. The burst parameters are set to their default values for each burst type.

```
Router(config)# cable modulation-profile 8 mix
Router(config)# exit
Router# show cable modulation-profile 8
```

| Mod | IUC     | Type | Preamb length | Diff enco | FEC T | FEC CW | Scrambl seed | Max B | Guard time | Last CW | Scrambl short | Preamb offset |
|-----|---------|------|---------------|-----------|-------|--------|--------------|-------|------------|---------|---------------|---------------|
| 8   | request | qpsk | 64            | no        | 0x0   | 0x10   | 0x152        | 0     | 8          | no      | yes           | 0             |
| 8   | initial | qpsk | 128           | no        | 0x5   | 0x22   | 0x152        | 0     | 48         | no      | yes           | 0             |
| 8   | station | qpsk | 128           | no        | 0x5   | 0x22   | 0x152        | 0     | 48         | no      | yes           | 0             |
| 8   | short   | qam  | 144           | no        | 0x6   | 0x4B   | 0x152        | 6     | 8          | yes     | yes           | 0             |
| 8   | long    | qam  | 160           | no        | 0x8   | 0xDC   | 0x152        | 0     | 8          | yes     | yes           | 0             |

```
Router#
```



### Note

The above example shows the default values for the burst parameters. The main differences in the default values between 16-QAM and QPSK bursts are in the Type and Preamble Length fields.

The following example shows how to define the burst parameters for profile 2 as follows:

The request burst is defined to have 0 fec-tbytes, 16 kbytes fec-len, a burst-len of 1, a guard time of 8, a mod value of qpsk, scrambler enabled with a seed value of 152, differential encoding disabled, a preamble length of 64 bits, a fixed code word length, and 8-bit unique words for upstream unique word length. The remaining request data, initial, station, short, and long bursts are defined in similar fashion for profile 2.

```
Router(config)# cable modulation-profile 2 request 0 16 1 8 qpsk scrambler 152 no-diff 64
fixed uw8
Router(config)# cable modulation-profile 2 reqdata 0 16 1 8 qpsk scrambler 152 no-diff 64
fixed uw8
Router(config)# cable modulation-profile 2 initial 5 34 0 48 qpsk scrambler 152 no-diff
128 fixed uw16
Router(config)# cable modulation-profile 2 station 5 34 0 48 qpsk scrambler 152 no-diff
128 fixed uw16
Router(config)# cable modulation-profile 2 short 6 75 6 8 16qam scrambler 152 no-diff 144
fixed uw8
Router(config)# cable modulation-profile 2 long 8 220 0 8 16qam scrambler 152 no-diff 160
fixed uw8
```



### Note

You must create all of the bursts (request, initial, station, short and long) for this modulation profile, using the **modulation profile** command. The reqdata burst is optional.

See the **show cable modulation-profile** command for a description of the output display fields.

## Related Commands

| Command                                  | Description                                        |
|------------------------------------------|----------------------------------------------------|
| <b>cable upstream modulation-profile</b> | Assigns a modulation profile to an interface.      |
| <b>show cable modulation-profile</b>     | Displays a modulation profile group's information. |

# cable spectrum-group hop period

To change the minimum time between frequency hops, use the **cable spectrum-group hop period** command in global configuration mode. To reset the frequency hop interval for this spectrum group to its default value, use the **no** form of this command.

**cable spectrum-group** *groupnum* **hop period** *seconds*

**no cable spectrum-group** *groupnum* **hop period**

| Syntax Description |                 |                                                                                              |
|--------------------|-----------------|----------------------------------------------------------------------------------------------|
|                    | <i>groupnum</i> | Spectrum group number. Valid values are from 1 to 32.                                        |
|                    | <i>seconds</i>  | Specifies the frequency-hop time period in seconds. Valid values are from 1 to 3600 seconds. |

| Defaults |            |
|----------|------------|
|          | 25 seconds |

| Command Modes |                      |
|---------------|----------------------|
|               | Global configuration |

| Command History | Release    | Modification                                                                                                                                                                   |
|-----------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | 12.1 T     | This command was introduced.                                                                                                                                                   |
|                 | 12.1(7)CX1 | The default <b>hop period</b> was changed from 300 seconds to 25 seconds to accommodate the new spectrum management features for the Cisco uBR-MC16S spectrum management card. |

| Usage Guidelines |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | The <b>cable spectrum-group hop period</b> command defines the minimum amount of time that must pass between upstream frequency hops. If ingress noise becomes excessive on a particular upstream, you can set this time period to a smaller value, so as to allow frequency hopping to continue more rapidly until a clear channel is found. Conversely, if the problem appears to be a transient condition, such as a defective cable modem generating a large volume of errored packets, this time period can be increased to a larger value, so as to avoid excessive frequency hopping by allowing more time between frequency hops. |

On the MC1xC cards, the maximum recommended hop period is 20 seconds. On the MC16S card, the minimum recommended hop period is 25 seconds and the maximum recommended hop period is 35 seconds.



#### Note

The hop period should be set to at least 25 seconds on the Cisco uBR-MC16S line card so that transient network problems that are unrelated to ingress noise do not generate unnecessary frequency hops.

**Examples**

The following example shows how to change the minimum frequency-hop interval to 60 seconds. This means that frequency hops for this spectrum group cannot occur more quickly than once every 60 seconds, even if other characteristics, such as exceeding the CNR or FEC threshold values, would normally trigger the hop.

```
router(config)# cable spectrum-group 1 hop period 60
```

**Related Commands**

| Command                                   | Description                                                                                                                  |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>cable modulation-profile</b>           | Creates a cable modulation profile.                                                                                          |
| <b>cable spectrum-group hop threshold</b> | Specifies a hop threshold for a cable spectrum group.                                                                        |
| <b>cable upstream channel-width</b>       | Configures an upstream for a range of allowable channel widths.                                                              |
| <b>cable upstream modulation-profile</b>  | Configures an upstream for one modulation profile (static profile) or two modulation profiles (Dynamic Upstream Modulation). |
| <b>show cable hop</b>                     | Displays the current hop period and threshold for an upstream, along with other statistics.                                  |

# cable spectrum-group hop threshold

To specify a frequency hop threshold for a spectrum group, use the **cable spectrum-group hop threshold** command in global configuration mode. To delete the hop threshold for this spectrum group, use the **no** form of this command.

**cable spectrum-group** *groupnum* **hop threshold** [*percent*]

**no cable spectrum-group** *groupnum* **hop threshold**

| Syntax Description |                 |                                                                                                                                                       |
|--------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <i>groupnum</i> | Spectrum group number. Valid values are from 1 to 32.                                                                                                 |
|                    | <i>percent</i>  | (Optional) Specifies the frequency hop threshold as a percentage of station maintenance messages that are lost. Valid range is from 1 to 100 percent. |

**Defaults** 20 percent

**Command Modes** Global configuration

| Command History | Release    | Modification                                                                                                                                                                      |
|-----------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | 12.1 T     | This command was introduced.                                                                                                                                                      |
|                 | 12.1(7)CX1 | The default <b>hop threshold</b> was changed from 100 percent to 20 percent to accommodate the new spectrum management features for the Cisco uBR-MC16S spectrum management card. |

**Usage Guidelines** The Cisco CMTS sends a station maintenance message to each cable modem at least once every 25 to 30 seconds. If a cable modem does not respond to a station maintenance message within that time period, the CMTS then resends station maintenance messages at a faster rate (typically one second apart) in an attempt to restore connectivity with the cable modem.

Station maintenance messages can be lost because cable modems have lost connectivity with the CMTS, or because ingress noise and other factors are causing dropped and errored packets. Downstream noise can also affect the delivery of station maintenance messages. When a user-configurable percentage of station maintenance messages are lost, the CMTS hops to a new upstream frequency to improve connectivity and sends out an Upstream Channel Descriptor (UCD) update to the cable modems to inform them of the change.

The optimal hop threshold value depends on several factors, including the quality of the upstream return path and the number of cable modems on the upstream. In addition, the hop threshold works together with the hop period so that transient network problems do not generate an unnecessary number of frequency hops. Ideally, the hop threshold should be set low enough so that the frequency hop can occur before a significant number of cable modems go offline, but not so low that it generates frequency hops that are not needed.

For example, if the hop threshold is at its default of 20 percent and an upstream has 100 active cable modems, a power outage that affected 20 cable modems would usually cause a frequency hop since this is a loss 20 percent of cable modems, which in turn would be responsible for at least 20 percent loss of station maintenance messages. But in this situation, the frequency hop would be unneeded since changing the upstream frequency could not correct the original problem (the power outage). If this were a common situation on this upstream, the network administrator might increase the hop threshold so that the repeated power outages would not generate unneeded frequency hops.

If, on the other hand, the power outage affected only 10 cable modems, a frequency hop would not occur unless another factor, such as ingress noise, created a sufficient loss of station maintenance messages to reach the 20 percent threshold. In this situation, the default threshold of 20 percent might be sufficient.

Downstream problems can also generate frequency hops. For example, if 20 cable modems were on a particularly noisy downstream, over time they could miss a sufficient number of station maintenance messages to generate a frequency hop. The network administrator could increase the hop threshold to limit the possibility of frequency hops due to downstream impairments.

Also, faulty cable modems could generate a frequency hop under certain conditions. For example, if a number of faulty cable modems generated a large number of uncorrectable forward error correction (FEC) errors or otherwise missed 50 to 60 percent of their station maintenance messages, without actually going offline, over time they could cause a frequency hop or modulation change. The network administrator could increase the hop threshold to prevent the CMTS from generating a frequency hop or modulation change for problems such as these, which are unrelated to actual noise on the upstream.

**Note**

If a previous frequency hop had already occurred within the user-configurable hop period, the CMTS will not immediately frequency hop. Instead, the CMTS would wait until the hop period expires, and if the percentage of station maintenance messages still exceeds the hop threshold, the CMTS would perform another frequency hop.

**Tip**

When an upstream has 25 or fewer cable modems (which is typical with lab and test environments), the CMTS increases the rate at which it sends station maintenance messages to the cable modems. This higher polling rate, along with the small number of cable modems, means that frequency hopping can occur more quickly than with a normally loaded upstream, especially when a few number of cable modems are powered down or generate noisy traffic.

**Note**

The DOCSIS specification states that when a cable modem misses 16 sequential station maintenance messages, the CMTS should consider the cable modem offline and should stop sending station maintenance messages to that cable modem. The cable modem must then reregister with the CMTS to resume connectivity.

**Examples**

The following example shows how set the threshold that triggers frequency hop to 25 percent of station maintenance messages on the upstream that is assigned to spectrum-group 4:

```
router(config)# cable spectrum-group 4 hop threshold 25
```

| Related Commands | Command                                  | Description                                                                                                                  |
|------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                  | <b>cable modulation-profile</b>          | Creates a cable modulation profile.                                                                                          |
|                  | <b>cable spectrum-group hop period</b>   | Sets the minimum frequency-hop interval for a cable spectrum group.                                                          |
|                  | <b>cable upstream channel-width</b>      | Configures an upstream for a range of allowable channel widths.                                                              |
|                  | <b>cable upstream modulation-profile</b> | Configures an upstream for one modulation profile (static profile) or two modulation profiles (Dynamic Upstream Modulation). |
|                  | <b>show cable hop</b>                    | Displays the current hop period and threshold for an upstream, along with other statistics.                                  |

# cable upstream hop-priority

To configure the priority of the corrective actions to be taken when a frequency hop is necessary due to ingress noise on the upstream, use the appropriate **cable upstream hop-priority** command in cable interface configuration mode.

**cable upstream *n* hop-priority frequency modulation channel-width**

**cable upstream *n* hop-priority modulation frequency channel-width**

**cable upstream *n* hop-priority frequency channel-width modulation**

|                           |                                             |                                                                                                                                                                        |
|---------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax Description</b> | <i>n</i>                                    | Port number for an upstream on the Cisco uBR-MC16S (0–6).                                                                                                              |
|                           | <b>frequency, modulation, channel-width</b> | Specifies the priority of corrective actions to be taken when ingress noise occurs on a downstream.                                                                    |
|                           | <b>Note</b>                                 | The <b>channel-width</b> option must come after the <b>frequency</b> option, either immediately or after the <b>modulation</b> option, as shown in the above examples. |

**Defaults** The default priority is **frequency, modulation, and channel-width**.

**Command Modes** Cable interface configuration

| <b>Command History</b> | <b>Release</b> | <b>Modification</b>                                                                                               |
|------------------------|----------------|-------------------------------------------------------------------------------------------------------------------|
|                        | 12.1(7)CX1     | This command was introduced for Cisco uBR7200 series routers using the Cisco uBR-MC16S cable interface line card. |

**Usage Guidelines** This command specifies the priority of the corrective actions that should be taken when a frequency hop is necessary to correct excessive ingress noise on an upstream. For example, if the upstream is set for the default settings (**frequency, modulation, and channel-width**), the following occurs when the upstream noise exceeds the CNR threshold value for the current modulation profile:

1. The Cisco uBR-MC16S changes to a new frequency, if a clean frequency is available in its spectrum group.
2. If no clean frequency is available, the Cisco uBR-MC16S uses the Dynamic Upstream Modulation feature to switch the upstream to the secondary modulation profile.
3. If the noise levels still exceed the CNR threshold value for the secondary modulation profile, and if the upstream has been configured for a range of channel widths, the Cisco uBR-MC16S narrows the channel width of the upstream by half. If the noise levels are still excessive, the channel width is again cut in half, and this process continues until a clean upstream is found or the bandwidth is reduced to the minimum channel width that has been configured using the **cable upstream channel-width** command.

Allowable DOCSIS channel widths are 3.2 MHz, 1.6 MHz, 800 KHz, 400 KHz, and 200 KHz. If the channel width drops to 200 KHz, but the noise still exceeds the CNR/SNR threshold, the cable modems will go offline.



**Note** The default specifies only a single channel width of 1.6 MHz. If this is not changed to specify a range of allowable channel widths (using the **cable upstream channel-width** command), the Cisco uBR-MC16S does not attempt to change the channel width.

To use the Dynamic Upstream Modulation feature, you must first create two modulation profiles (using the **cable modulation-profile** command) and assign them to the upstream (using the **cable upstream modulation-profile** command).

### Examples

The following example specifies that when ingress noise on the upstream exceeds the threshold allowed for the primary modulation profile, the Cisco uBR-MC16S line card should first switch to the secondary modulation profile, then try frequency hopping, and if that fails to correct problem, to finally try narrowing the channel width:

```
Router(config)# interface cable 3/0
Router(config-if)# cable upstream 0 hop-priority modulation frequency channel-width
Router(config-if)# exit
Router(config)#
```

### Related Commands

| Command                                  | Description                                                                                                                  |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>cable modulation-profile</b>          | Creates a cable modulation profile.                                                                                          |
| <b>cable upstream channel-width</b>      | Configures an upstream for a range of allowable channel widths.                                                              |
| <b>cable upstream modulation-profile</b> | Configures an upstream for one modulation profile (static profile) or two modulation profiles (Dynamic Upstream Modulation). |
| <b>show cable hop</b>                    | Displays the current hop period and threshold for an upstream, along with other statistics.                                  |
| <b>show cable modulation-profile</b>     | Displays the cable modulation profiles that have been created.                                                               |

# cable upstream modulation-profile

To assign one or two modulation profiles to an upstream port, use the **cable upstream modulation-profile** command in cable interface configuration mode. To assign modulation profile 1 to the upstream port and to disable the Dynamic Upstream Modulation feature) use the **no** form of this command.

**cable upstream *n* modulation-profile *primary-profile-number* [*secondary-profile-number*]**

**no cable upstream *n* modulation-profile *primary-profile-number* [*secondary-profile-number*]**

| Syntax Description |                                 |                                                                                                                                                                                |
|--------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <i>n</i>                        | Port number on the cable modem slot (port numbers begin with a 0).                                                                                                             |
|                    | <i>primary-profile number</i>   | Number identifying the primary modulation profile for the upstream port. The primary modulation profile is used when the upstream is operating with nominal noise conditions.  |
|                    | <i>secondary-profile number</i> | Secondary modulation profile for the upstream port, which is used when noise on the upstream increases to the point that the primary modulation profile can no longer be used. |
|                    | <b>Note</b>                     | The secondary modulation profile should specify a more robust performance profile (in terms of coping with noise) than the primary profile.                                    |

**Defaults** A single primary modulation profile (profile 1)

**Command Modes** Cable interface configuration

| Command History | Release                   | Modification                                                                                                                               |
|-----------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                 | 11.3 NA                   | This command was first introduced.                                                                                                         |
|                 | 12.0(7)XR2 and 12.1(1a)T1 | This command was introduced into the 12.x trains                                                                                           |
|                 | 12.1(3a)EC1               | This command was modified to add the optional <i>secondary-profile-number</i> parameter to enable the Dynamic Upstream Modulation feature. |
|                 | 12.1(5)EC                 | This command was introduced for the Cisco uBR7100 series universal broadband routers.                                                      |
|                 | 12.1(7)CX1                | This command was enhanced for the Cisco uBR-MC16S line card.                                                                               |

**Usage Guidelines** The **cable upstream modulation-profile** command can assign one or two modulation profiles to an upstream port, depending on the type of cable interface and Cisco IOS software release being used.

### Static Modulation Profile (single profile)

The **cable upstream modulation-profile** command can assign a single modulation profile to an upstream port on the Cisco uBR7100 series routers and on all cable interface line cards that are available for the Cisco uBR7200 series routers. This modulation profile affects all cable modems and set-top boxes that are using that upstream port.

### Dynamic Upstream Modulation (dual profiles)

When the **cable upstream modulation-profile** command assigns two modulation profiles to an upstream port, it activates the Dynamic Upstream Modulation feature. This feature operates differently, depending on the Cisco IOS software release and on the cable interface line card that is providing the upstream port:

- The upstream port is on a Cisco uBR7100 series router or on a Cisco uBR-MC1xC, uBR-MC28C, or uBR-MC16E line card that is used on Cisco uBR7200 series router running Cisco IOS Release 12.1(3a)EC1 or a later 12.1 EC release.

When using the Dynamic Upstream Modulation feature, the primary modulation profile is the default profile. The line card tracks the upstream signal quality by monitoring the signal-to-noise ratio (SNR) value and forward error correction (FEC) counters for the upstream. When the noise on the upstream exceeds the threshold for the primary profile, the upstream switches to the secondary modulation profile. When the noise conditions improve (defined as a SNR value that is 3 dB greater than the threshold value and FEC counters that are below the threshold values), the upstream automatically switches back to the primary modulation profile. If the noise conditions continue to worsen, however, the line card begins frequency hopping to find a cleaner upstream channel.

For example, the primary modulation profile could be configured for 16-QAM (or mixed 16-QAM and QPSK) operation, while the secondary profile could be configured for QPSK operation. If noise conditions on the upstream threaten to force cable modems offline, the upstream switches to the secondary profile to implement QPSK operation. When the noise ingress conditions are solved, the upstream switches back to 16-QAM operation.




---

**Note** For more information on this form of the Dynamic Upstream Modulation feature, see the Cisco IOS Release 12.1(3a)EC1 feature module, *Cisco uBR7200 Series Dynamic Upstream Modulation*.

---

When Dynamic Upstream Modulation is enabled and spectrum groups are configured on the same interface, the line cards respond to excessive noise by first switching to the secondary modulation profile. If noise conditions worsen, the line card attempts to find a new upstream channel by frequency hopping, and if that fails, the line card reduces the channel width.

- The upstream port is on a Cisco uBR-MC16S line card that is used on Cisco uBR7200 series routers using Cisco IOS Release 12.1(7)CX1.

The Dynamic Upstream Modulation feature on the Cisco uBR-MC16S line card is identical to that for other line cards except that the spectrum management hardware on board the Cisco uBR-MC16S line card uses the carrier-to-noise ratio (CNR) instead of the SNR value. The CNR value is a more accurate description of noise conditions on the upstream. Because of this, the Cisco uBR-MC16S line card will switch back to the primary modulation profile when noise conditions improve to a CNR value that is only 1 dB greater than the threshold value (assuming FEC counters being below the threshold values).



**Note** If the Cisco uBR7200 series router is running Cisco IOS Release 12.1(3a)EC1 or a later 12.1 EC release, the Dynamic Upstream Modulation feature on the Cisco uBR-MC16S line card operates the same as it does on the other line cards.

When Dynamic Upstream Modulation is enabled and spectrum groups are configured on the same interface, the line cards respond to excessive noise by taking the first corrective action, as determined by the **cable upstream hop-priority** command (either frequency hopping or changing to the secondary modulation profile). If noise conditions worsen, the line card takes the second corrective action that has been defined, and if that fails, the line card takes the last corrective action.

**Note**

The Dynamic Upstream Modulation feature uses the DOCSIS-specified thresholds for 16-QAM and QPSK operation to determine when to switch modulation profiles. Cisco therefore recommends that the primary profile use 16-QAM or mixed 16-QAM/QPSK modulation and that the second profile use QPSK modulation. However, this is not mandatory, and the two profiles could be the same (16-QAM or QPSK), but the secondary profile should still be considered a more robust profile than the primary in terms of coping with noise conditions.

**Tip**

Modulation profiles must be first created using the **cable modulation-profile** command before they can be assigned using the **cable upstream modulation-profile** command.

**Examples**

The following example assigns the primary modulation profile 2 and the secondary modulation profile 1 to upstream port 0 on the cable interface card in slot 3. This automatically enables the Dynamic Upstream Modulation feature for all cable modems using that upstream.

```
Router(config)# interface cable 3/0
Router(config-if)# cable upstream 0 modulation-profile 2 1
Router(config-if)#
```

**Related Commands**

| Command                              | Description                                                                                                                |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>cable modulation-profile</b>      | Creates a cable modulation profile.                                                                                        |
| <b>cable upstream hop-priority</b>   | Determines the order of the corrective actions to be taken when ingress noise exceeds the allowable value for an upstream. |
| <b>show cable modulation-profile</b> | Displays the cable modulation profiles that have been created.                                                             |

# cable upstream threshold

To configure the upstream for the CNR and FEC threshold values to be used in determining the allowable noise levels, use the **cable upstream threshold** command in cable interface configuration mode.

```
cable upstream n threshold cnr-profile1 threshold1-in-dB cnr-profile2 threshold2-in-dB
corr-fec fec-corrected uncorr-fec fec-uncorrected
```



## Note

This command can be used only on upstreams on the Cisco uBR-MC16S cable interface line card.

## Syntax Description

|                         |                                                                                                                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>n</i>                | Port number on the cable modem slot (port numbers begin with a 0).                                                                                                |
| <b>cnr-profile1</b>     | Specifies the CNR threshold for the primary modulation profile specified for the upstream                                                                         |
| <i>threshold1-in-DB</i> | Threshold in dB (5–35, default is 25)                                                                                                                             |
| <b>cnr-profile2</b>     | Specifies the CNR threshold for the secondary modulation profile specified for the upstream                                                                       |
| <i>threshold2-in-DB</i> | Threshold in dB (5–35, default is 15 dB and must be less than the primary threshold)                                                                              |
| <b>corr-fec</b>         | Specifies the allowable number of correctable FEC errors for the upstream                                                                                         |
| <i>fec-corrected</i>    | Forward error correction (FEC) corrected threshold as a percentage of total packets received on the upstream during the polling period (3–50, default of 3)       |
| <b>uncorr-fec</b>       | Specifies the allowable number of uncorrectable FEC errors for the upstream                                                                                       |
| <i>fec-uncorrected</i>  | Forward error correction (FEC) uncorrected threshold as a percentage of total packets received on the upstream during the polling period (1–10, default of 1)     |
| <b>Note</b>             | For normal plant use, Cisco recommends that the uncorrectable FEC threshold remain at its default of 1% to avoid an unacceptable number of errors on the channel. |

## Defaults

The CNR threshold for the primary modulation profile defaults to 25 dB. The CNR threshold for the secondary modulation profile defaults to 15 dB. The correctable FEC error threshold defaults to 3% of total packets received, and the uncorrectable FEC error threshold defaults to 1% of total packets received.

## Command Modes

Cable interface configuration

## Command History

| Release    | Modification                                                                                                      |
|------------|-------------------------------------------------------------------------------------------------------------------|
| 12.1(7)CX1 | This command was introduced for Cisco uBR7200 series routers using the Cisco uBR-MC16S cable interface line card. |

**Usage Guidelines**

Separate CNR thresholds are assigned to the primary and secondary modulation profiles. Both profiles, however, are assigned the same correctable and uncorrectable FEC values.

**Note**

The uncorrectable FEC error count includes packets that have header checksum errors and “no unique word detected” errors.

**Examples**

The following example shows upstream 5 configured with the CNR threshold for the primary modulation profile set to 20 dB, the CNR threshold for the secondary modulation profile set to 10 dB, the correctable FEC error rate set to 5% of total packets received on the upstream, and the uncorrectable FEC error rate set to 1% of total packets received on the upstream:

```
Router(config)# interface cable 3/0
Router(config-if)# cable upstream 5 threshold cnr-profile1 20 cnr-profile2 10 corr-fec 5
uncorr-fec 1
Router(config-if)#
```

**Related Commands**

| Command                                  | Description                                                                                                                  |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>cable modulation-profile</b>          | Creates a cable modulation profile.                                                                                          |
| <b>cable upstream hop-priority</b>       | Determines the order of the corrective actions to be taken when ingress noise exceeds the allowable value for an upstream.   |
| <b>cable upstream modulation-profile</b> | Configures an upstream for one modulation profile (static profile) or two modulation profiles (Dynamic Upstream Modulation). |
| <b>show cable hop</b>                    | Displays the current hop period and threshold for an upstream, along with other statistics.                                  |
| <b>show cable modulation-profile</b>     | Displays the cable modulation profiles that have been created.                                                               |

# show cable modem

To display information for the registered and unregistered cable modems, use the **show cable modem** command in privileged EXEC mode.

**show cable modem** [*ip-address* | *interface* | *mac-address*] [*options*]

| Syntax Description                                                                                     |                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ip-address</i>                                                                                      | Identifies the IP address of a specific modem to be displayed                                                                                                                                                           |
| <i>interface</i>                                                                                       | Displays all cable modems on a specific CMTS cable interface                                                                                                                                                            |
| <i>mac-address</i>                                                                                     | Identifies the MAC address of a specific cable modem to be displayed                                                                                                                                                    |
| <b>Available options when displaying information for a cable interface or for a single cable modem</b> |                                                                                                                                                                                                                         |
| <b>access-group</b>                                                                                    | Displays access group.                                                                                                                                                                                                  |
| <b>connectivity</b>                                                                                    | Displays connectivity content.                                                                                                                                                                                          |
| <b>counters</b>                                                                                        | Displays cable counters.                                                                                                                                                                                                |
| <b>errors</b>                                                                                          | Displays cable error details.                                                                                                                                                                                           |
| <b>flap</b>                                                                                            | Displays flap content.                                                                                                                                                                                                  |
| <b>mac</b>                                                                                             | Displays the DOCSIS MAC version and capabilities.                                                                                                                                                                       |
| <b>maintenance</b>                                                                                     | Displays station maintenance error statistics.                                                                                                                                                                          |
| <b>offline</b>                                                                                         | Displays cable modems that are offline.                                                                                                                                                                                 |
| <b>phy</b>                                                                                             | Displays the phy layer content.                                                                                                                                                                                         |
| <b>registered</b>                                                                                      | Displays information for cable modems that have registered with the CMTS.                                                                                                                                               |
| <b>summary</b>                                                                                         | Displays the total number, number of active, and number of registered modems per interface. This option can be used with <b>total</b> and <b>upstream</b> options to display details for specific line cards and ports. |
| <b>unregistered</b>                                                                                    | Displays information for cable modems that have not registered with the CMTS.                                                                                                                                           |
| <b>verbose</b>                                                                                         | Displays detailed information.                                                                                                                                                                                          |
| <b>Available options when displaying information for a single cable modem</b>                          |                                                                                                                                                                                                                         |
| <b>classifiers</b>                                                                                     | Displays the classifiers for the modem.                                                                                                                                                                                 |
| <b>classifiers cache</b>                                                                               | Displays the classifiers in the cache maintained for each cable modem. (This cache is based on IP header field values and speeds up classifier lookups and reduces per packet processing overhead.)                     |
| <b>classifiers verbose</b>                                                                             | Displays detailed information for the modem's classifiers.                                                                                                                                                              |
| <b>cpe</b>                                                                                             | Displays the CPE devices accessing the cable interface through the cable modem.                                                                                                                                         |
| <b>cnr</b>                                                                                             | (For Cisco uBR-MC16S only) Displays the carrier/noise ratio (CNR) for the specified cable modem (in dB).                                                                                                                |

**Defaults** No default behavior or values

**Command Modes** Privileged EXEC

Command History

| Release    | Modification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.3XA     | This command was introduced.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11.3(5)NA  | Output was reorganized and the Receive Power field was added.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 12.0(3)T   | This command was ported to Cisco IOS Release 12.0 T.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 12.0(4)XI  | Output was expanded to show primary service identifier (SID) and customer premises equipment (CPE) count.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 12.0(7)XR  | The <b>offline</b> option was added.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 12.0(7)T   | The <b>detail</b> option was replaced with the <b>verbose</b> option.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 12.1(4)CX  | The following options were added to this command:<br><br><ul style="list-style-type: none"> <li><b>connectivity</b> (it was removed from the <b>show interface sid</b> command)</li> <li><b>counters</b></li> <li><b>errors</b></li> <li><b>flap</b></li> <li><b>mac</b></li> <li><b>phy</b></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 12.1(6)EC  | The <b>show cable modem summary</b> command was enhanced with the following options to display per-card and per-port totals: <ul style="list-style-type: none"> <li>• <b>show cable modem summary total</b>—Displays a summary and a total for all modems on the chassis.</li> <li>• <b>show cable modem summary cable x/0 total</b>—Displays a summary of modems on a specified card.</li> <li>• <b>show cable modem summary cable x/0 upstream port1 port2 total</b>—Displays a summary of modems on the specified card and specified range of ports.</li> <li>• <b>show cable modem summary cable x/0 cable y/0 total</b>—Displays a summary of modems on the specified range of cards.</li> <li>• <b>show cable modem summary cable x/0 cable y/0 upstream port1 port2 total</b>—Displays a summary of modems on the specified range of ports on the specified range of cards.</li> </ul> |
| 12.1(7)CX1 | The <b>cnr</b> option was added for Cisco uBR7200 series routers using the Cisco uBR-MC16S line card.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Usage Guidelines

This command displays information for all cable modems, all cable modems attached to a specific CMTS cable interface, or for a particular CM that is identified by its IP address or MAC address.

Examples

The following sample output from the **show cable modem** command shows the default displays for individual CMs.

```
Router# show cable modem
MAC Address      IP Address      I/F      MAC          Prim RxPwr  Timing Num  BPI
                IP Address      State    Sid   (db)  Offset CPEs Enbld
0010.7b6b.58c1  0.0.0.0        C4/0/U5  offline     5    -0.25  2285  0   yes
0010.7bed.9dc9  0.0.0.0        C4/0/U5  offline     6    -0.75  2290  0   yes
0010.7bed.9dbb  0.0.0.0        C4/0/U5  offline     7     0.50  2289  0   yes
0010.7b6b.58bb  0.0.0.0        C4/0/U5  offline     8     0.00  2290  0   yes
0010.7bb3.fcd1  10.20.113.2    C5/0/U5  online      1     0.00  1624  0   yes
0010.7bb3.fcdd  0.0.0.0        C5/0/U5  init(r1)    2    -20.00  1624  0   no
```

```

0010.7b43.aa7f 0.0.0.0          C5/0/U5 init(r2)    3    7.25  1623  0    no

Router# show cable modem 0010.7bb3.fcd1
MAC Address    IP Address      I/F      MAC          Prim RxPwr Timing Num  BPI
                State          Sid   (db)  Offset CPEs  Enbl'd
0010.7bb3.fcd1 10.20.113.2    C5/0/U5 online    1    0.00  1624  0    yes

```

The default display shows the following information for each modem:

**Table 7** Descriptions for the Default show cable modem Fields

| Field         | Description                                                                 |
|---------------|-----------------------------------------------------------------------------|
| MAC Address   | The MAC address for the CM.                                                 |
| IP Address    | The IP address that the DHCP server has assigned to the CM.                 |
| I/F           | The cable interface line card providing the upstream for this CM.           |
| MAC State     | The current state of the MAC layer (see <a href="#">Table 8</a> ).          |
| Prim SID      | The primary SID assigned to this CM.                                        |
| RxPwr         | The received power level (in dB) for the CM.                                |
| Timing Offset | The timing offset for the CM.                                               |
| Num CPEs      | Indicates the number of CPE devices for which the CM is providing services. |
| BPI Enbl'd    | Indicates whether BPI encryption is enabled for the CM.                     |

[Table 8](#) shows the possible values for the MAC state field:

**Table 8** Descriptions for the MAC State Field

| MAC State Value                                        | Description                                                                                               |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Registration and Provisioning Status Conditions</b> |                                                                                                           |
| init(r1)                                               | The CM sent initial ranging.                                                                              |
| init(r2)                                               | The CM is ranging.                                                                                        |
| init(rc)                                               | Ranging completed.                                                                                        |
| init(d)                                                | DHCP request received.                                                                                    |
| init(i)                                                | DHCP reply received and IP address has been assigned.                                                     |
| init(o)                                                | The option file (DOCSIS configuration file) transfer has started.                                         |
| init(t)                                                | Time of Day (TOD) exchange has started.                                                                   |
| <b>Non-error Status Conditions</b>                     |                                                                                                           |
| offline                                                | The CM is considered offline (disconnected or powered down).                                              |
| online                                                 | The CM has registered and is enabled to pass data on the network.                                         |
| online(d)                                              | The CM registered, but network access for the CM has been disabled through the DOCSIS configuration file. |
| online(pk)                                             | The CM registered, BPI is enabled and KEK assigned.                                                       |
| online(pt)                                             | The CM registered, BPI is enabled and TEK assigned; BPI encryption is now being performed.                |

**Table 8** Descriptions for the MAC State Field (continued)

| MAC State Value                | Description                                                                                              |
|--------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Error Status Conditions</b> |                                                                                                          |
| reject(m)                      | The CM attempted to register; registration was refused due to a bad Message Integrity Check (MIC) value. |
| reject(c)                      | The CM attempted to register; but registration was refused due to a bad Class of Service (COS) value.    |
| reject(pk)                     | KEK key assignment is rejected, and BPI encryption has not been established.                             |
| reject(pt)                     | TEK key assignment is rejected, and BPI encryption has not been established.                             |

The following example shows sample output for the **summary** option:

```
Router# show cable modem summary
Interface                Cable Modem
                        Total Registered Unregistered Offline
Cable4/0/U5              4      0           4           4
Cable5/0/U5              3      1           2           0
```

The following example shows sample output for the **summary** option for all enabled cable interface line cards:

```
Router# show cable modem summary total
Interface      Total      Active      Registered
              Modems    Modems      Modems
Cable5/0       746        714        711
Cable6/0       806        764        759

Total:         1552      1478      1470
```

The following example shows sample output for the **summary** option for all enabled upstreams on a specific cable interface line card:

```
Router# show cable modem summary c5/0 total
Interface      Total      Active      Registered
              Modems    Modems      Modems
Cable5/0/U0    294        272        271
Cable5/0/U1    256        248        246
Cable5/0/U2    196        194        194

Total:         746        714        711
```

The following example shows sample output for the **phy** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 phy
MAC Address    USPwr  USSNR  Timing MicroReflec DSPwr  DSSNR
              (dBmV) (dBmV) Offset (dBc)      (dBmV) (dBmV)
0010.7bb3.fcd1 0      25.16      0      0      0      -----
```

The following example shows sample output for the **mac** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 mac
MAC Address    MAC          Prim Ver    Frag Concat PHS  Priv  DS  US
              State      Sid
0010.7bb3.fcd1 online      1      DOC1.0 no    no    no  BPI  0  0
```

The following example shows sample output for the **maintenance** option for a particular CM:

```
Router# show cable modem 0010.7bb3.fcd1 maintenance
MAC Address      I/F          Prim SM Exhausted      SM Aborted
                  Sid    Count Time          Count Time
0010.7bb3.fcd1 C5/0/U5    1     3     Jun 1 10:24:52 0     Jan 1 00:00:00
```

The following example shows sample output for the **connectivity** option for a particular cable modem:



**Note** The **connectivity** option has been moved from **show int sid** command to the **show cable modem** command, because the connectivity statistics are per-cable modem statistics and are better managed from the cable modem instance.

```
Router# show cable modem 0010.7bb3.fcd1 connectivity
Prim 1st time      Times %online      Online time          Offline time
Sid  online      Online      min   avg   max   min   avg   max
1    May 30 2000 4      99.85 48:20 11h34m 1d2h23m 00:01 00:59 03:00
```

The following example shows sample output for the **flap** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 flap
MAC Address      I/F          Ins  Hit  Miss  CRC  P-Adj  Flap  Time
0010.7bb3.fcd1 C5/0/U5    0    36278 92    0    369    372  Jun 1 13:05:23
```

The following example shows sample output for the **qos** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 qos
Sfid Dir Curr Sid  Sched Prio MaxSusRate MaxBrst  MinRsvRate Throughput
      State      Type
3    US  act  1    BE    7    2000000    1522    100000    0
4    DS  act  N/A  BE    0    4000000    1522    0          0
```

The following example shows sample output for the **classifiers** option for a particular cable modem:

```
Router# show cable modem 0010.7b6b.7215 classifiers
CfrId SFID      cable modem Mac Address  Direction  State  Priority  Matches
2     1988      0010.7b6b.7215  US          act       101
```

The following example shows sample output for the **counter** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 counter
MAC Address      US Packets  US Bytes  DS Packets  DS Bytes
0010.7bb3.fcd1 1452082    171344434 1452073    171343858
```

The following example shows sample output for the **errors** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 errors
MAC Address      I/F          CRC      HCS
0010.7bb3.fcd1 C5/0/U5    0         0
```

The following example shows sample output for the **cpe** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 cpe
SID  Priv bits  Type      State  IP address  method  MAC address
1    00         modem    up     10.20.113.2  dhcp    0010.7bb3.fcd1
```

The following example shows sample output for the **access-group** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 access-group
MAC Address      IP Address      Access-group
0010.7bb3.fcd1 10.20.113.2    N/A

Upstream Power          : 42 dBmV (SNR = 10 dBmV)
```

```
Downstream Power          : 15 dBmV (SNR = 15 dBmV)
```

The following example shows sample output for the **verbose** option for a particular cable modem:

```
Router# show cable modem 0010.7bb3.fcd1 verbose
MAC Address                : 0010.7bb3.fcd1
IP Address                  : 10.20.113.2
Prim Sid                    : 1
Interface                   : C5/0/U5
Upstream Power              : 42 dBmV (SNR = 10 dBmV)
Downstream Power            : 15 dBmV (SNR = 15 dBmV)
Timing Offset               : 1624
Received Power              : 0.25
MAC Version                 : DOC1.0
Capabilities                 : {Frag=N, Concat=N, PHS=N, Priv=BPI}
Sid/Said Limit              : {Max Us Sids=0, Max Ds Sids=0}
Optional Filtering Support  : {802.1P=N, 802.1Q=N}
Transmit Equalizer Support  : {Taps/Symbol= 0, Num of Taps= 0}
Number of CPEs              : 0(Max CPEs = 0)
Flaps                       : 373(Jun 1 13:11:01)
Errors                      : 0 CRCs, 0 HCSes
Stn Mtn Failures            : 0 aborts, 3 exhausted
Total US Flows               : 1(1 active)
Total DS Flows               : 1(1 active)
Total US Data                : 1452082 packets, 171344434 bytes
Total US Throughput          : 0 bits/sec, 0 packets/sec
Total DS Data                : 1452073 packets, 171343858 bytes
Total DS Throughput          : 0 bits/sec, 0 packets/sec
```

The following example shows sample output for the **registered** option, which can be used with or without a cable modem address. If you specify a cable modem address, information for that cable modem is displayed only if the cable modem has actually registered with the CMTS. The display for the **unregistered** option is identical to that shown for the registered option, except that it shows cable modems that have not yet registered with the CMTS.

```
Router# show cable modem 10.20.114.34 registered
Interface Prim Online      Timing Rec   QoS CPE IP address      MAC address
          Sid  State      Offset Power
C6/0/U5   1    online    2808 0.25  2   1  10.20.114.34   00d0.ba77.7595
```



**Note**

The QoS field displays the QoS profile assigned to the cable modem and appears only for DOCSIS 1.1 cable modems.

The following example shows sample output for the **cnr** option for a particular cable modem:

```
Router# show cable modem 10.20.114.34 cnr
MAC Address   IP Address   I/F           MAC           Prim  cnr
              State      Cable3/0/U5  State        Sid   (db)
00d0.ba77.7595 10.20.114.34 Cable3/0/U5  online       1    38.00
```

# show cable spectrum-group

To display information about spectrum groups on a Cisco uBR7200 series cable router, use the **show cable spectrum-group** command in privileged EXEC mode.

**show cable spectrum-group** [*groupnum*] [**detail**]

|                           |                 |                                                                                                                                                             |
|---------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax Description</b> | <i>groupnum</i> | (Optional) Displays information about the specified group number (1–32). If no group number is specified, information for all spectrum groups is displayed. |
|                           | <b>detail</b>   | (Optional) Displays whether the groups are allocated, free, or in-use.                                                                                      |

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

| <b>Command History</b> | <b>Release</b> | <b>Modification</b>                  |
|------------------------|----------------|--------------------------------------|
|                        | 12.1 T         | This command was introduced.         |
|                        | 12.1(7)CX1     | The <b>detail</b> keyword was added. |

**Examples** The following is sample output from the **show cable spectrum-group** command for all upstream spectrum groups:

```
CMTS01# show cable spectrum-group
Group No.   Frequency Band      Upstream Port      Weekly Scheduled Availability      Power Level      Shared Spectrum
          (Mhz)
1          5.000-42.000
1          17.328 [1.60] Cable3/0 U0
1          5.808 [1.60] Cable3/0 U1
1          5.808 [1.60] Cable3/0 U2
1          15.792 [1.60] Cable3/0 U3
1          6.096 [1.60] Cable3/0 U4
1          5.808 [1.60] Cable3/0 U5
2          5.000-42.000
2          6.608 [3.20] Cable6/0 U1
2          5.808 [1.60] Cable6/0 U2
2          5.808 [1.60] Cable6/0 U3
2          5.808 [1.60] Cable6/0 U4
2          5.808 [1.60] Cable6/0 U5
3          5.000-42.000
3          17.488 [1.60] Cable5/0 U1
3          6.160 [1.60] Cable5/0 U2
3          36.912 [1.60] Cable5/0 U3
3          36.560 [1.60] Cable5/0 U4
3          16.240 [1.60] Cable5/0 U5
4          6.000- 8.600
4          16.000-18.000
```

```

4      17.168 [1.60] Cable5/0 U0      0
5      5.000-42.000                    0      No
6      5.000-42.000                    0      No
7      5.000-42.000                    0      No
8      5.000-42.000                    0      No
9      5.000-42.000                    0      No
10     5.000-42.000                    0      No
11     5.000-42.000                    0      No
12     10.000-13.000                   0      No
CMTS#

```

The following is sample output from the **show cable spectrum-group detail** command for all upstream spectrum groups:

```

CMTS01# show cable spectrum-group detail
Group  Frequency      Upstream   Weekly Scheduled   Power   Shared
No.    Band              Port       Availability        Level  Spectrum
      (Mhz)
      From Time:    To Time:        (dBmV)
1      5.000-42.000   Cable3/0 U0      0      No
  A    5.000-42.000   Cable3/0 U0
2      20.000-26.000 Cable3/0 U1      0      No
  A    20.000-26.000 Cable3/0 U1
3      5.000- 9.000   Cable3/0 U2      0      No
  A    5.000- 9.000   Cable3/0 U2
4      12.000-13.600                    0      No
4      5.000- 6.500                    0      No
4      5.000- 6.600                    0      No
  A    12.000-13.600
  A    5.000- 6.600
CMTS01#

```

Table 9 describes the fields shown in the **show cable spectrum-group** displays.

**Table 9** show cable spectrum-group Command Field Descriptions

| Field                         | Description                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spectrum-Group                | Identifies the spectrum group.                                                                                                                                                                                                                                                                                                                                                         |
| Frequency Band (MHz)          | Identifies the upper and lower ranges of the frequency for this spectrum group.                                                                                                                                                                                                                                                                                                        |
| Upstream Port                 | Identifies the upstream port number.                                                                                                                                                                                                                                                                                                                                                   |
| Weekly Scheduled Availability | Identifies the day and time of day when this group is available. If no values appear in the <b>From</b> and <b>To Time</b> fields, this group is available at all times.                                                                                                                                                                                                               |
| Input PowerLevel              | Identifies the assigned decibels per millivolt (dBmV) input level.                                                                                                                                                                                                                                                                                                                     |
| Shared Spectrum               | Indicates if upstreams are physically combined (share the same combiner group). Y or yes values indicate that upstreams that are members of the spectrum group are combined and cannot be assigned overlapping frequency bands.<br><br>N or no values indicate that upstreams that are members of the spectrum group are not combined and can be assigned overlapping frequency bands. |

---

**Related Commands**

| <b>Command</b>                       | <b>Description</b>                                                                          |
|--------------------------------------|---------------------------------------------------------------------------------------------|
| <b>show cable hop</b>                | Displays the current hop period and threshold for an upstream, along with other statistics. |
| <b>show cable modulation-profile</b> | Displays modulation profile group information.                                              |

# show controllers cable upstream spectrum

To display the noise levels for a particular cable modem or to display the background noise for an entire upstream on the Cisco uBR-MC16 line card, use the **show controllers cable upstream spectrum** command in Privileged EXEC mode.

**show controllers cable *x/y* upstream *n* spectrum** [*ip-address* | *mac-address* ] *start-freq* *end-freq* *res-freq*

| Syntax             | Description                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>x/y</i>         | Slot numbers for the desired Cisco uBR-MC16S line card                                                                                                                                                                                                                                                                                |
| <i>n</i>           | Port number for the desired upstream (0–5)                                                                                                                                                                                                                                                                                            |
| <i>ip-address</i>  | (Optional) IP address, in dotted decimal notation, for a cable modem on the specified upstream.                                                                                                                                                                                                                                       |
| <i>mac-address</i> | (Optional) MAC address, in dotted hexadecimal notation, for a cable modem on the specified upstream                                                                                                                                                                                                                                   |
| <i>start-freq</i>  | Starting frequency for the frequency range that is being reported (5-42 MHz; can also be specified as 5000-42000 KHz or 5000000–42000000 Hz)                                                                                                                                                                                          |
| <i>end-freq</i>    | Ending frequency for the frequency range that is being reported (5-42 MHz)<br><br><b>Note</b> The ending frequency must be greater than the starting frequency and must be specified using the same units as the starting frequency (MHz, KHz, Hz).                                                                                   |
| <i>res-freq</i>    | Resolution frequency to determine the number of data points for the report (12-37000 KHz).<br><br><b>Note</b> The resolution frequency must be specified in the same units as the starting and ending frequency (MHz, KHz, Hz). To use a resolution value less than 1 MHz, you must specify the other parameters in either Hz or KHz. |

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

| Command History | Release    | Modification                                                                                                      |
|-----------------|------------|-------------------------------------------------------------------------------------------------------------------|
|                 | 12.1(7)CX1 | This command was introduced for Cisco uBR7200 series routers using the Cisco uBR-MC16S cable interface line card. |

**Usage Guidelines**

The **show controllers cable upstream spectrum** command displays the power in dBmV for a given frequency range for the specified upstream. The frequency range can cover any portion of the DOCSIS upstream frequency range (5–42 MHz), and the frequency range can be divided into a resolution as small as 12 KHz.

If a cable modem is specified by its IP address or MAC address, the power information for that particular cable modem is given. If no IP or MAC address is given, the command displays the background noise for the entire upstream. All displays use historical averaging of data collected at the time the command is used; historical information is not saved.

**Note**

Cisco's cable interface line cards always program the upstream's center frequency in 16 KHz increments, and this is the frequency displayed by the **show controller cable upstream** command. For example, if you use the **cable upstream frequency** command to specify a frequency of 27 MHz, the actual center frequency will be 27.008 MHz, which is the next highest 16 KHz boundary.

**Examples**

The following example shows the show controllers cable upstream command displaying the power information for a particular cable modem on upstream 5 of cable interface slot 3/0. The power information is displayed over the entire upstream (5–42 MHz), with a resolution of 5 MHz:

```
Router# show cable modem
MAC Address      IP Address      I/F      MAC      Prim  RxPwr  Timing  Num  BPI
                  State          State
...
00d0.ba77.7595  10.20.114.34   C3/0/U5  online   1     0.25  2740   1    yes
00d0.ba77.7621  10.20.114.17   C3/0/U5  online   2     0.25  2740   2    yes
00d0.ba77.7533  10.20.114.55   C3/0/U5  online   3     0.25  2740   1    yes
...
```

```
Router# show controllers cable 3/0 upstream 5 spectrum 10.20.114.34 5 42 5
```

```
02:16:49: Spectrum DATA(@0x4B060004) for u5: 4995-41991KHz(resolution 4992KHz, sid 1):
02:16:49: Freq(KHz) dBmV Chart
02:16:49: 4995 : -5 *****
02:16:49: 9987 : -7 *****
02:16:49: 14979: -24 *****
02:16:49: 19971: -35 *****
02:16:49: 24963: -39 *****
02:16:49: 29955: -35 *****
02:16:49: 34947: -37 *****
02:16:49: 39939: -35 *****
Router#
```

**Note**

The output for each frequency range includes a timestamp, the ending frequency for each range (in KHz), the historical average power level for that range (in dBmV), and a series of asterisks that provides a graphical representation of noise floor level for the signal (a stronger signal is indicated by more asterisks).

The following example shows a partial display of the background noise data for upstream 4 of cable interface slot 6/0. The command covers the entire upstream spectrum (5–42 MHz) at the minimum resolution of 12 KHz.

```
Router# show controller cable 6/0 upstream 4 spectrum 5000 42000 12
```

```
02:15:54: Spectrum DATA(@0x4B060004) for u5: 4995-41991KHz(resolution 12KHz, sid 1):
```

```

02:15:54: Freq(KHz) dBmV Chart
02:15:54: 4995 : -100
02:15:54: 5007 : -67
02:15:54: 5019 : -67
02:15:54: 5031 : -67
02:15:54: 5043 : -64
02:15:54: 5055 : -64
02:15:54: 5067 : -61
...
02:15:54: 8199 : -67
02:15:54: 8211 : -61
02:15:54: 8223 : -64
02:15:54: 8235 : -57
02:15:54: 8247 : -49 ***
02:15:54: 8259 : -52 **
02:15:54: 8271 : -46 *****
02:15:54: 8283 : -45 *****
02:15:54: 8295 : -52 **
02:15:54: 8307 : -48 *****
02:15:54: 8319 : -45 *****
02:15:54: 8331 : -41 *****
02:15:54: 8343 : -39 *****
02:15:54: 8355 : -39 *****
02:15:54: 8367 : -40 *****
02:15:54: 8379 : -43 *****
02:15:54: 8391 : -44 *****
02:15:54: 8403 : -33 *****
02:15:54: 8415 : -32 *****
02:15:54: 8427 : -30 *****
02:15:54: 8439 : -27 *****
02:15:54: 8451 : -28 *****
02:15:54: 8463 : -36 *****
02:15:54: 8475 : -40 *****
02:15:54: 8487 : -37 *****
02:15:54: 8499 : -40 *****
02:15:54: 8511 : -39 *****
02:15:54: 8523 : -28 *****
02:15:54: 8535 : -29 *****
02:15:54: 8547 : -27 *****
02:15:54: 8559 : -29 *****
02:15:54: 8571 : -40 *****
02:15:54: 8583 : -36 *****
02:15:54: 8595 : -28 *****
02:15:54: 8607 : -30 *****
...
02:15:54: 11247: -40 *****
02:15:54: 11259: -44 *****
02:15:54: 11271: -44 *****
02:15:54: 11283: -46 *****
02:15:54: 11295: -46 *****
02:15:54: 11307: -42 *****
02:15:54: 11319: -46 *****
02:15:54: 11331: -48 *****
02:15:54: 11343: -53 *
02:15:54: 11355: -55
02:15:54: 11367: -54 *
02:15:54: 11379: -57
02:15:54: 11391: -61
02:15:54: 11403: -60
02:15:54: 11415: -60
02:15:54: 11427: -60
02:15:54: 11439: -61
02:15:54: 11451: -57
02:15:54: 11463: -58

```

```
02:15:54: 11475:    -67
02:15:54: 11487:    -58
...
```

| Related Commands | Command                                  | Description                                                                                                                  |
|------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                  | <b>cable modulation-profile</b>          | Creates a cable modulation profile.                                                                                          |
|                  | <b>cable upstream hop-priority</b>       | Determines the order of the corrective actions to be taken when ingress noise exceeds the allowable value for an upstream.   |
|                  | <b>cable upstream modulation-profile</b> | Configures an upstream for one modulation profile (static profile) or two modulation profiles (Dynamic Upstream Modulation). |
|                  | <b>show cable hop</b>                    | Displays the current hop period and threshold for an upstream, along with other statistics.                                  |
|                  | <b>show cable modulation-profile</b>     | Displays the cable modulation profiles that have been created.                                                               |
|                  | <b>show controllers cable upstream</b>   | Displays detailed statistics for the upstream.                                                                               |

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This document is to be used in conjunction with the documents listed in the “[Related Documents](#)” section on page 6.

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